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The point regarding the desirability of uniform signs at grade crossings which Mr. Stein raised at yesterday's session of the Engineering Association's convention is worthy of serious consideration. Since the advent of the automobile the amount of traffic crossing railways at high speed has very greatly increased, thereby, of course, adding to the danger of crossing accidents. Crossing signs should, it would seem, in the interest of safety, be uniform as to location, prominence and general appearance, so that persons passing along the streets and roads crossing the lines of different roads will always be able to recognize a sign from a considerable distance wherever it may be. Crossing signs usually are prominently displayed, but they are not uniform, either as to location or general appearance; and, no doubt, a good many grade crossing accidents are due to this. The questions as to what are the best location and the best general appearance to adopt are matters about which there will be differences of opinion, but there can be little difference of opinion as to the desirability of uniformity. Mr. Stein referred to one case where a state railway commission was considering issuing an order in regard to crossing signs, and the increasing activities of the commissions indicate that numerous state bodies are likely to take such action. If the Engineering Association should adopt a uniform specification it seems probable that any orders that might be issued by commissions would require the signs to be made according to the Association's specifications, which would be very much better than that each commission should make a different requirement on this subject.

The Committee on Buildings has carried on a thorough investigation of the subject of roof coverings during the past two years. Last year a very complete report was presented, and considerable supplemental information was added this year. The committee deserves a great deal of credit for the thoroughness with which it has conducted this investigation and the frankness with which the different products are discussed in the report. The committee has labored under unusual difficulties both in the securing of information and in presenting it in its reports. The roofing business is highly competitive, and the rivalry between the different companies is keen. Because of this condition highly exaggerated claims have been made for the various products, and the purchaser has been largely at the mercy of the manufacturers, being unable to secure reliable information concerning the relative merits of the different articles. The committee met with the same difficulty in trying to secure information, but by persistence has partially overcome it. In discussing the various materials in such a frank manner the committee has given the membership the information so badly needed and put it up in such shape as to leave little doubt as to the committee's conclusions. This real constructive work makes the report of definite value to the association.

The tendency noticeable at this year's convention to confine discussions of the various committee reports to their important features is a healthy one. The members in most cases confined their remarks to the larger points brought out, and the time which in previous conventions frequently was spent in lengthy arguments over unimportant details has been conserved for really constructive purposes. Last year, it will be remembered, considerable time was devoted in one instance to a discussion of the relative merits of round or flat hoops for water tanks after the committee had studied the subject carefully and made recommendations in accordance with well-defined practice. The discussion this year on the specifications for frogs and switches, beginning Tuesday afternoon and continuing Wednesday morning, was in marked contrast to this. While this discussion was long, it was constructive, and brought out considerable additional information which should be of value to the committee in its further study. One reason for the improvement in the discussions this year undoubtedly is that, with one exception, the committee reports were in the hands of the members at least several days in advance of the convention, and they have had opportunity to digest them. Last year the members were handicapped by not receiving the reports until just before the convention. The Board of Direction is to be complimented on its success in getting the reports completed so early, as this, undoubtedly, is contributing much to the convention's success. The completion of reports on time is an important part of committee work. In several past instances a committee has prepared a report after thorough and consistent study, and has had it rejected or torn to pieces as a result of discussion based on snap judgment or on a hurried reading of the reports while they were being presented.

The effect of the popularity of the automobile and the tendency, which it typifies, toward luxuriousness in almost everything under the sun, including the railways, has long been a prolific theme of discussion. Ray Morris referred

to a phase of the subject in his address at the annual dinner of the Engineering Association, pointing out that this "development in applied extravagance" has been responsible for the constantly increasing demands upon the railways for luxurious equipment, costly stations and other increased expenditures, while increasing the interest rates at which securities can be marketed. There has also been some speculation as to the effect of the automobile on railway travel. Last summer P. S. Eustis, passenger traffic manager of the Burlington, while canvassing his station agents for an explanation of a temporary diminution in passenger business, was able to locate specifically several ways in which to a certain degree the increasing rise of the automobile was cutting into the passenger receipts. In one case the purchase of a large number of automobiles in a small town greatly reduced the number of tickets sold during a Chautauqua meeting in a town a score of miles distant, although the attendance at the meeting was larger than the year before. Several agents observed that traveling salesmen were using automobiles to make a number of towns a day in districts where infrequent train service had formerly limited the territory that could be covered in a day. In other instances people who in previous years had taken vacation railway journeys were substituting the recreation of a motor tour or of frequent short rides. Mr. Morris was not at all pessimistic regarding the situation he depicted. Neither was Mr. Eustis concerning that which he had observed. Everyone knows that railway passenger traffic is not being diminished either by the automobile or by any other cause, but that it is steadily increasing from year to year. While the high cost of living and the cost of high living have had the same effect on the railways that they have had on the rest of mankind, the tendency that induces people to buy automobiles is the same that persuades others to travel by railway. For each person who buys an automobile there are thousands who cannot command the price of that luxury, but who do buy more and better clothing, household furnishings and groceries, which are transported by and pay freight to the railways.

THE CONSERVATION OF TIMBER BY RAILWAYS.

As the railways of the United States consume annually approximately 15 per cent. of the lumber, 40 per cent. of the coal and 10 per cent. of the crude oil produced, it is proper that they should take a reasonable interest in the conservation of these products, and the American Railway Engineering Association is well justified in publishing from year to year valuable statistics which serve to emphasize the importance of the work, as well as the progress attained. In its report this year on the Conservation of Natural Resources is a good bibliography of articles pertaining to the timber resources of the United States, a number of articles on fuel oil for locomotives, one on methods of preventing waste in the petroleum industry, and one on waste in coal mining. The report proper deals principally with tree planting and general reforestration.

The prodigal use of lumber in the United States is shown by the statement that, not including loss from fire, there is taken from the forests annually 23 billion cu. ft. of wood, or three times the yearly growth. This large consumption amounts to 230 cu. ft. per capita; while Germany uses 37 cu. ft., and France only 25 cu. ft., per capita. The comparison is still more unfavorable when it is found that even with this apparently small consumption, Germany and France have well-established systems of reforestration which keep a more even balance of production and consumption. The American Railway Engineering Association report of 1910 on the future policy of railways with reference to tie supply considered at length the purchase and management by railways of forest lands, and discussed the project of buying forest land in eastern Texas for about $3.25 per acre for the production of loblolly pine, which trees reach their maturity in 40 years. The conclusion reached was that the purchase and management of forest lands by railways was not only possible but eminently desirable at that date, but in the short time since that report all prices have advanced in Texas as elsewhere, and at present the project might not be so favorably considered. This shows the importance of prompt action by railways if they desire to acquire forest land for these purposes.

The present condition of railway finances and the restrictions surrounding their earnings are such as to discourage building or planting for the distant future. The Norfolk & Western, the Pennsylvania, the Delaware & Hudson, the Northern Pacific and the Southern Pacific have established a plan of forest management, and seven or eight lines have been planting trees for tie timber. Beyond this, little has been done by the railways since 1910, when details of this work were reported. The committee concludes that from present indications it will not be safe to depend on tree planting by railways for any important addition to the supply of tie timber. Most railways do not own forest tracts or any extent of land where tree planting can be profitably conducted, and their best work will be in rendering what assistance they can to the systematic forestry undertaken by the states and the federal government. Much can be done by the reduction of waste in various forms. The preservation of ties is now helping largely in this direction and is rapidly growing. A beginning has been made this year in the treatment of car lumber, and this should become more general. The preservation of wooden structures along the right of way will be found profitable in many cases, and the extensive use of concrete for miscellaneous structures which have heretofore been made of wood and having a short life, will also effect a saving in the amount of lumber required for renewals.

A preventable waste now involving large losses is that due to forest fires. The value of standing timber destroyed from this cause amounts in some seasons to $100,000,000 and averages yearly more than $50,000,000. The lines passing through the Cascade mountains have equipped locomotives for burning oil for the purpose of preventing forest fires, and further east the railways are working with the state forestry officials in order to devise means for preventing fires started by sparks from locomotives.

The lumbering methods are often to blame for leaving the railway right of way in bad condition after logging operations, and concerted action for improving this is desirable. The committee has therefore concluded to take up, as the most important subject for next year's work, an investigation of the forest fire laws of the different states as they apply to the railways, and the best methods for reducing risk from forest fires caused by locomotive sparks.

ECONOMICS OF RAILWAY LOCATION.

Railway work can be broadly divided into construction and operation. The work of the American Railway Engineering Association relates largely to both branches. In most cases the fundamental formulae, together with the data necessary for the calculations connected with the different investigations undertaken, are at hand and well established by long experience. The work of the committee on Economics of Railway Location covers both construction and operating problems, and in these fields the necessary information is in most cases not at hand. The

committee finds its chief difficulty in getting operating statistics in such form as to be readily available for its purpose. The report this year, while brief, is not as discouraging as that of last year, when the chairman said: "Nothing of real value can be done by this committee if they are not furnished with sufficient information on which to base conclusions, and if this is not forthcoming the committee should be released from further study of the subject."

This appeal has produced good results, and the committee is now able to report that it is greatly encouraged by the receipt of considerable valuable operating data; so that it hopes to present in the coming year new methods of analysis which may help to clear up some of the uncertainties which make the study of the subject so complex. In the relation of track facilities to cost of operation, it is becoming apparent that no general fixed values can be established for distance, curvature, rise and fall or gradient. The cost may vary with the number of train miles, the ratio of freight and passenger train mileage and the density of traffic both as to train mileage and ton mileage. All these questions require the compilation of detailed statistics, and a very careful study of these statistics, before accurate conclusions can be drawn. This is but one phase of the broad and exceedingly important field which is before this committee. It is doubtful if any committee has any more important work now before it than this one, especially at the present time, when railways are all devoting their attention to effecting economies in operation. On many roads the problem now is not the construction of extensions to gather new traffic, but the handling economically of the traffic already coming to it and the provision of facilities for increasing these economies. The remarkable increase in train loading made on the Baltimore & Ohio last year was undoubtedly due in large measure to the careful study of grades and their effect on train rating which has been carried on by that road within the past three or four years.

This class of investigation and study requires a large amount of analytical work which exceeds the limits of time which the individual members of the committee are able to devote to it without neglecting their regular office duties. For this reason it is very necessary that those members of the committee who are doing the work have the full support of the entire personnel of the committee in order that the amount of work necessary for each individual member to do will be reduced to a minimum. Furthermore, the committee reports inability to secure information from certain sources which it is essential that it have for the successful prosecution of its work. In view of the great importance of this investigation to the railways in general, it is to be regretted that action on the part of a few roads tends to cripple the effectiveness of the committee as a whole. It is to be hoped that they will realize the importance of the work and give it their support. In some cases this lack of support has perhaps been due to the fact that the information asked for was not readily available in the form requested, and the roads were unwilling to go to the expense of having it prepared from their records. It is to be hoped that they will co-operate as far as possible with the committee in order that the best results may be secured.

Comparatively little comprehensive study has been undertaken on the subject of economics of railway location since that conducted by the late A. N. Wellington and included in his book on Economics of Railway Location, which was first published in 1887 and revised two years later. In spite of the fact that a great many changes have taken place in both track and locomotive design and operation in the past 25 years, this book is still standard to-day, although the figures given in it are out of date. There is opportunity and a demand for similar studies of operating conditions at the present time, in order to put out a standard authority for use under present-day operating conditions. The most thorough contribution in this line made in recent years was that by J. B. Berry on Grade Revision on the Union Pacific, published as a bulletin of the American Railway Engineering Association in 1904. A similar paper was prepared by John D. Isaacs several years ago outlining the study made before grade revision was undertaken on the main line of the Southern Pacific, and also published as a bulletin of this association.

The dynamometer car has been improved in several important particulars in recent years, and its results are far more accurate than those secured by the use of older cars. The exact measurements made possible by electrical devices and by tests made with electric locomotives add to the fund of new data which render necessary a revision of that obtained from the older instruments, and all this needs to be digested, tabulated and analyzed as a contribution to the work of this important committee. The very large increase in tractive power made available by the use of Mallet locomotives, their enormous cost and the large expense for their maintenance, must have proper consideration in order to balance the reduction in cost due to slight grade reductions. The motive power department must, therefore, contribute its proper share in furnishing reliable figures to show the cost of operation with different types of motive power.

In shop operations, a large amount of special study has been given to increased efficiency with resulting economies which have prevented locomotive and car repairs from reaching extravagant figures. While the efficiency expert has often been extravagant in his claims, more rational workers have quietly effected vast economies in the maintenance of equipment. A few specialists properly directed could produce a body of valuable data on the economics of railway location, and the large sums involved in the construction work now going on would well justify the expenditure necessary for this analysis.

The traffic of the country is rapidly outgrowing the capacity of single and double track lines, and much of the new construction is on multiple tracks. When multiple tracks are taken up for long distances the question of proper location becomes important. It is fair to say, therefore, that the most extensive construction work which will be done by railways in the next few years involves questions of economic location, and should have applied to it all the accurate data which is available. The St. Paul has just finished its double track between Chicago and St. Paul; and the Santa Fe has completed its second track between Chicago and Newton, Kan. The Illinois Central is completing double track between Chicago and New Orleans; the Erie is now double-tracked within 240 miles of Chicago, and the Baltimore & Ohio is working in the same direction. All these and numerous others are lines with a large traffic well developed, and much more data is available for determining economic location than when the single tracks were built.

The low freight rates of the United States, and their tendency to become lower, make the most careful economy necessary, and the proper location of second track is a complex problem which involves close calculation and the use of new data, which should be placed in shape for the purpose, even if it is necessary to expend a reasonable amount for extra salaries, until some co-operation in this direction is established. The lines which have valuable statistics should be willing to spend a small sum necessary to place them in good shape for the committee's purpose.

Proceedings.

The Thursday morning session of the American Railway Engineering Association was called to order at 9:15 o'clock by President Cushing.

CONSERVATION OF NATURAL RESOURCES.

The following subjects were assigned:

(1) Continue the study of tree-planting and general reforestation.

(2) Continue the study of coal and fuel oil resources.

(3) Continue the study of iron and steel resources.

In presenting the report, which is naturally one of progress, the committee realizes that there is a great difference between the practical application of "Conservation of Natural Resources" to the everyday business conditions met by the members of the association and the purely sentimental ideals which may be indulged in by the world in general.

It is felt also that while the committee was originally formed to co-operate with the National Conservation Commission of this country, as well as with the Commission of Conservation

E. O. FAULKNER.

Chairman Committee on Conservation of Natural Resources.

of Canada, yet its principal object was to keep under special observation those particular features in which the railways were directly and practically interested.

It is hoped that the information which the committee has been able thus far to collect, may, in the method and form in which it is here given, be easy of reference as well as productive of practical benefit to our members, and through them to the railways in general.

The report is signed by E. O. Faulkner (A. T. & S. F.), Chairman; William McNab (G. T.), Vice-Chairman; R. H. Aishton (C. & N. W.), Moses Burpee (B. & A.), F. F. Busteed (C. P.), C. H. Fisk (T. A. & G.), W. A. McGonagle (D. M. & N.), G. A. Mountan (Can. Ry. Com.), W. L. Park (I. C.), G. H. Webb (M. C.).

TREE PLANTING AND GENERAL REFORESTATION IN THE UNITED STATES.

As leading up to the necessity for tree planting and reforestation, it would seem desirable to consider, first, the extent and location of existing forests, their annual increment, and the yearly consumption of forest products.

These questions were very fully reported upon by the National Conservation Commission. The commission was assisted in its labors by experts whose papers form the basis of the report. These papers, representing as they do the original work of experts, form a body of evidence along the various lines pertaining to the timber resources of the country, which will be found valuable for reference.

The original forests of the United States exceeded in the quantity and variety of their timber the forests of any other region of similar size on the globe. Five great forest types were distinguished—the northern, southern, central, Rocky Mountain and Pacific Coast. The kinds of timber and extent of these forests are presented in Table 1.

In addition to these timbered areas there were probably 100,000,000 acres of scrub forest and brush land, chiefly in the West, which has been and still is a source of much post and fuel material.

The Bureau of Corporations estimates that there is a total of about 2,800 billion board ft. of standing timber in the country. Of this about 2,200 billion ft. is privately owned, about 539 billion ft. is in the National forests, and about 90 billion ft. is on the unreserved public lands, national parks, state lands and Indian reservations.

The results of the Bureau's investigation of the amount of standing timber in the United States may be summarized as shown in Table 2.

TABLE 2.

STANDING TIMBER IN THE UNITED STATES.

		Billion Feet.
Privately owned timber in investigation area:		
Pacific Northwest	1,013	
Southern Pine Region	634	
Lake States	100	
	1,747	
Outside of investigation area	450	
		2,197
Total owned by Federal Government in National forests		539
Total otherwise owned by Federal Government, owned by States and on Indian reservations		90
Grand Total		2,826

The earliest attack was upon the white pine of the Northeast, the original stand of which is almost entirely cut out. From Table 2 it is apparent that at the present time the two great sources of timber supply, so far as privately owned timber is concerned, are the Pacific Northwest, with 1,013 billion ft. and the Southern pine region, with 634 billion ft. Moreover, 82 per cent of the standing timber owned by the United States Government is in the Pacific Northwest, and nearly all of the remainder is in the other states of the Rocky Mountain region.

The yearly growth of wood in our forests does not average more than 12 cu. ft. per acre. This gives a total yearly growth of less than seven billion cubic feet. That our forests grow very slowly, although the individual trees of many kinds grow fast, is our fault. There are about 200 million acres of mature forest mainly in the northern Rockies and on the Pacific Coast in which the yearly growth is balanced by decay.

There are 250 million acres, mostly in the Southern mountains and Southern pine belt, partly cut or burned over, but restocking naturally with young growth and 100 million acres chiefly in the Lake States and Southern pine belt which have been cut or burned over upon which young growth is wholly lacking or too scanty to make merchantable timber.

There is taken from the forest annually, not including loss from fire, 23 billion cu. ft. of wood or over three times its yearly growth. This large consumption amounts to 230 cu. ft. per capita, while Germany uses 37 cu. ft. and France 25 cu. ft.

Each year there is used 90,000,000 cords of fire wood, 40,000,000,000 board feet of lumber, more than 1,000,000,000 posts, poles and fence rails, 118,000,000 hewn ties, 1,500,000,000 staves, over 133,000,000 sets of heading, nearly 500,000,000 barrel hoops, 3,000,000 cords of native pulp wood, 165,000,000 cubic feet of round mine timbers, and 1,250,000 cords of wood for distillation.

The condition of the world supply of timber makes us already dependent upon what we produce. There is exported out of the country one and one-half times as much timber as is brought in, and except for finishing woods, relatively insignificant in quantity, we must rely upon our own resources for the future supply.

The Forest Service estimates the yearly drain on the saw timber of the country at about 50 billion board feet. Without allowing either for new growth or for any increase in the rate of consumption the total for all the timber in the United States would represent about 55 years' supply, and that for privately owned timber alone only 44 years' supply.

These conditions affect the railways of the country not only as they are concerned in the production of timber for their own use, but from the broader viewpoint of developing the territory traversed by their lines. The destruction of the timber is followed by a rapid decline of the industries utilizing the products of the forest with a corresponding loss of revenue for the roads serving the region.

Turning our attention to the conservation of the forest it will be seen that by the introduction of proper forestry methods the annual productivity of the forest can be considerably increased and that the yearly loss from avoidable causes is much greater than it should be. There are 225 million acres of producing forest in the country. On this area the stand is so open that all the trees could be grown on 145 million acres, which would be producing at the rate of 70 cu. ft. per acre annually. By growing only the best species this

growth can be increased to 80 cu. ft., an increase of 1,450 million cu. ft.

There is an unutilized area of 80 million acres within our present producing forest. There are 135 million acres of absolute forest land within our virgin or mature forests now unproductive. There are 90 million acres of waste lands which can be made productive by planting, or by fire protection all of these areas can be made to produce 80 cu. ft. per acre, or a total of 24,400 million cu. ft.

The total increase possible in the productiveness of our forests is, therefore, 25,850 million cu. ft.

Only 25 per cent of the yield of our present producing forest is saw timber. It can be made from 50 to 75 per cent saw timber through the concentration of growth on the best trees by thinning and the holding of the crop until it reaches good size. This would mean an increase, if all our forest land were productive, from 27,000 million board ft. to between 54,000 million and 81,000 million board ft. per annum.

The enormous loss from fire in our forests every year is a matter of common knowledge. The value of standing timber destroyed each season from this cause has varied from $25,000,000 to more than $100,000,000, the direct annual loss in recent years averaging considerably over $50,000,000. The destruction of young growth, though never included in estimates of fire damage, is a principal item of loss. The natural restocking of burned-over lands takes place very slowly or not at all.

All experiences go to prove that damage by forest fires is practically preventable. This stage of development has already been reached in Europe. For example, of 7 million acres in Prussia, an average of only 1,400 acres or one-fiftieth

Forest.	Kinds of Timber.	Quantity Billion F. B. M.	Extent Million Acres.
Northern..	Cone-bearing trees predominated, with some hardwoods..	1,000	150
Southern..	Coniferous forest with yellow pine predominating. Interspersed with the pine were a variety of hardwoods.....	1,000	220
Central....	This is the only forest region in the United States in which the hardwoods predominated.	1,400	280
Rocky Mountain..	Almost entirely coniferous.....	400	110
Pacific....	Almost entirely coniferous.....	1,400	90
Total..	.....	5,200	850

Original Forests of the United States, Table 1.

of 1 per cent was burned over each year during the period from 1868 to 1895.

The committee feels that the railways by working with the State Forestry officials can accomplish a great deal of good in the way of prevention of fires started by sparks from locomotives. The committee is assembling information from both the railway companies and the State Forest officials in regard to the laws governing the subject and the means used in different parts of the country to reduce the fire risk from this cause.

It would appear that a concerted action on the part of the railways and state officials is desirable, as the forest adjacent to the railway right-of-way is often left in such a condition after logging operations that it is a difficult matter to prevent fire starting, even when the greatest precaution is observed. Several roads are now working with the state foresters to accomplish this result; notably the Chicago & Northwestern in the state of Wisconsin.

While the chief loss in timber is due to fire, other causes contribute largely to the prodigious waste which has accompanied our use of the forest. One-fourth of the standing timber is left or otherwise lost in logging. The boxing of long leaf pine for turpentine has destroyed one-fifth of the forests worked. The loss in the mill is from one-third to two-thirds of the timber sawed. The loss in the mill product through seasoning and fitting for use is from one-seventh to one-fourth. Great damage is done by insects to forests and forest products. An average of only 320 ft. of lumber is used for each 1,000 ft. which stood in the forest.

Of all the wood in every form now in use in the United States, decay, fire, insects and saltwater borers destroy not less than the equivalent of 8,000 million board ft. each year. Of these, decay is far the most destructive.

The first attempt in this country to prevent decay by treating wood was in 1838 on the Northern Central Railroad. About a mile of track was laid with treated ties, but owing to the low first cost of the ties which were chestnut and oak and were delivered to the railway at 14 or 16 cents apiece, this did not develop into a permanent industry.

In 1880 for the first time the United States census undertook to ascertain what remained of our timber resources; it was found that they had been very rapidly depleted. Realizing the importance of the question the American Society of Civil Engineers appointed a committee to report upon the best methods of preserving wood, in order to lengthen its life. This committee was appointed in 1880 and after five years of work presented its report in 1885. This was followed by the movement which has culminated in the present large wood preservation industry of the country.

In the year 1910, 97,500,000 cu. ft. of timber was treated. Most of this material consisted of cross-ties. Sixty-three million cu. ft., which constituted about 65 per cent of the total, were treated with the creosote treatment and the remainder with zinc chloride and zinc creosote treatment in the order named

In the United States the science of forestry is still in the formation stage. Knowledge of the characteristics and requirements of the many species of trees composing the forests is limited; the total amount and distribution of forest wealth is not accurately known; and methods of administration are not yet settled, but are subject to frequent change. In Europe, on the contrary, forestry as practiced to-day is the result of centuries of gradual evolution, and is consequently thoroughly systematized and its methods firmly established. Foreign silvicultural methods are not usually applicable without change, but the general systems have been adapted with success to conditions in this country, and should be still more widely used.

A striking point concerning forestry abroad is the important part taken by the state in the management of communal and private as well as of the state forests, and the considerably greater returns obtained under state management. All communal forests are subject to some form of state supervision, and many of them are managed precisely as if they were state property.

Private forests necessary for the protection of water sheds or the welfare of the general public are also subject to state control; they cannot be cleared, cutting must be done as prescribed by the state, and all cuttings must be reforested. Other private forests not necessary for protective purposes can usually be managed as the owner desires, but co-operation with the state in the management of such forests is common.

With a few exceptions comparatively little attention has been paid by the railways to forestry. Tree plantations have been started in a number of cases, some of which have been on a large scale, but for the most part experimentally. Forest planting in some cases may be desirable when a railway has waste land for which it has no particular use. It is a good object lesson to the farmers, and if the plantations are successful they will net a fair return on the investment and furnish a limited supply of ties and timber for the future.

It should be observed, however, that it would not be practicable for the individual roads to plant enough trees to supply their timber requirements, and further the critical period of scarcity and high prices would come before any of the trees so planted would reach maturity.

The information assembled by the committee on ties in 1910 shows what has been done by the railways in the way of tree planting; the situation is very little changed at the present time and in the opinion of those best able to judge, relief from this source is very uncertain.

If the railways wish to provide against future scarcity and excessive prices with any degree of certainty it will be necessary for them to actively engage in forestry operations having for their purpose the management of mature timber lands and the cultivation and reforestation of the cut-over lands within the forest area. This is an individual problem with every road, but generally speaking it is the only sound policy which will provide for the future requirements fifteen or twenty years hence.

Some of the railways have now undertaken to preserve the timber lands which they acquired through land grants and otherwise. The Southern Pacific in Northern California and Southern Oregon still have quite large areas of good timber from which they can cut mature trees. The Northern Pacific has been co-operating with the Government for some years with a view to finding how best to handle their western holdings and provide a source of tie supply at the eastern end of their lines. In the East, the Delaware & Hudson have put about one hundred thousand acres in the Adirondacks under management.

RECOMMENDATION FOR NEXT YEAR'S WORK.

(a) Investigation of the forest fire laws of the different States as they apply to railways.

(b) The best methods to be used by railways to reduce risk from fires caused by locomotives.

COAL AND FUEL OIL RESOURCES.

The sub-committee dealing with this subject has read and examined a large mass of papers and various data, and submits papers on the advantages of oil as fuel; inspection, tests and specifications; methods of preventing or lessening waste in the petroleum industry, and the duration of the coal supply.

TREE PLANTING AND REFORESTATION IN CANADA.

The Forestry Branch of the Department of the Interior (Government of Canada) has, since 1900, been carrying out a scheme of free tree distribution to farmers in the prairie provinces of Manitoba, Saskatchewan and Alberta. During that time some eighteen million trees have been sent out from the nurseries of this particular branch. The trees are planted on the homesteads throughout these provinces for windbreaks, shelter belts and wood supply. Nurseries have been established also on some of the forest reserves, and some planting is being done.

In 1894, the Government of the Province of Ontario established a nursery at the Ontario Agricultural College, Guelph, Ont., and they have since been distributing trees to farmers throughout that province. This nursery has since been removed to St. Williams, Ont., where the Provincial Department of Agriculture has acquired some 1,300 acres of sandy land, which it is planting up with forest trees. The Province of Quebec has also established a forest nursery at Berthier, P. Q., but the distribution from there has, as yet, been small. In a few instances, planting or sowing has been undertaken in other provinces of the Dominion by individuals or private concerns.

The Canadian Pacific has taken in hand the planting of trees of different varieties on the prairies. The trees and shrubs used are Russian poplar and willows, box elder, ash, spruce, Scotch pine, caragana and artemosia. A good deal of this work is done along the cuts, in order that the trees and shrubs may serve as permanent snow fences.

There is also a permanentt plantation at Wolseley, Sask., to determine the values of different species of trees for tie purposes, as well as for the correct spacing and mixture. The species selected are native tamarack, Scotch, red and jack pine, and although the plantation has not been established long enough to give any reliable figures as to growth, the results so far have been satisfactory. This plantation is situated on dry upland prairie. The tamaracks, or larch, used were transferred from swamp land to the plantation, and the growth on the high land, so far, has been three times faster than at any time in the swamp. It is hoped that this plantation will ultimately afford reliable information as to the selecting and planting of such trees as will eventually be suitable for tie timber.

Investigations are also being made by the Canadian Pacific as to the value of cut-over and virgin timber lands in selected locations, in order to determine the value of these lands for permanent tie reserves. The information obtained from this source is not, as yet, sufficient to give out anything of a definite nature, but it will be continued, and in a few years it is also hoped that reliable information will be obtained regarding this reforestation.

The consumption of timber in the year 1910 was as follows:

Lumber	4,901,649,000 ft. B. M.
Square timber	37,962 tons
Shingles	1,976,400,000
Lath	851,953,000
Pulpwood	598,487 cords
Poles	782,841
Cross-ties	9,213,962
Mining timber (round)	52,848,000 linear ft.
Mining timber (sawn)	22,305,000 ft. B. M.
Cooperage (slack), including staves, heading and hoops	161,641,000 pieces
Cooperage (tight)	8,370,000 pieces

ANNUAL FIRE LOSS IN CANADA.

The information in regard to the annual fire loss is not definite, as much of the loss occurs in districts so far removed from settlement that it is impossible to make any reliable estimate. The annual loss from forest fires will, however, run between 250,000,000 and 500,000,000 ft., board measure, per annum. In very wet years it might fall below the minimum—in very dry years it will go over it. The value of the timber destroyed might be taken at one dollar per thousand at the stump. In the districts where railways are being constructed they are the most frequent cause of fire—at least 50 per cent of the fires being caused by them. In the districts beyond, where the railways are constructed, fires are mostly due to the clearing of the land by settlers.

COAL AND FUEL OIL RESOURCES IN CANADA.

In the Dominion the aggregate area of coal lands is 29,957 square miles, containing about 172,100,000,000 tons of the several classes.

Little, as yet, has been done towards ascertaining the loss incident upon coal mining operations in Canada. Nova Scotia has recently taken steps to secure this information by issuing coal depletion statement forms to be filled in by the mine operators. It has been stated by some authorities that for every ton of coal mined, one-half a ton is lost or wasted; and in thick beds the recovery probably does not exceed 30 per cent.

The wastes attending coal mining operations may be enumerated as follows:

(1) Coal lost beyond recovery by mining lowest seams first.
(2) Coal left in pillars to support the roof.
(3) The low-grade coal left in the mines.
(4) Slack coal formed during mining operations.

In Western Canada, where there are so many seams of great thickness close together, it is looked upon as important that the upper seams should be mined first, so that any caving as a result of removing the pillars will not render it impossible to get at the other seams.

Great losses have resulted also from improperly burned coal. The loss in smoke alone with bituminous coal has been estimated at about 10 per cent.

PEAT DEPOSITS IN CANADA.

In round numbers there are 37,000 square miles of peat lands scattered throughout the various provinces.

As a result of investigations carried on in Canada it has been demonstrated that:

(1) For the economic production of fuel from peat, machinery driven by power must be substituted as far as possible for manual labor.

(2) That processes so far invented for removing the water content of the peat by pressure or artificial heat have not hitherto led to profitable commercial results.

A number of bogs, however, are being exploited to some extent, and the result of the operation of one of them in particular, viz., the plant at Alfred, Ont., goes to prove that the production of excellent peat fuel is a commercial possibility.

It has been found that one ton of peat burned under boilers is equal to about 5/9 of a ton of coal. It does not clinker, nor give off any objectionable volatile matter in the form of black smoke, and as a domestic fuel it is clean, easily handled and efficient.

CRUDE PETROLEUM IN CANADA.

The waste which occurs in oil production in Canada is not so much in the oil itself as in the natural gas incident to the oil production. The oil, when obtained, may be sold at once, whereas, to sell the gas, long, expensive pipe lines must be laid, franchises obtained from towns or cities, and their market is but limited.

NATURAL GAS IN CANADA.

The production of natural gas in Canada has increased in value nearly ten-fold during the last eighteen years, and of the total amount the Province of Ontario produced about 95 per cent.

Steps were taken by the Ontario government in 1907 to prevent the waste of natural gas, and a law was passed levying a tax of two cents per 1,000 feet, with a rebate of 90 per cent when the gas is used in Canada. This provision has been very effective.

In Alberta little provision has as yet been made for the plugging of the gas wells, and many millions of cubic feet have therefore been wasted annually and extended areas have been more or less drained.

In order to conserve the supply of natural gas the gas must be utilized (1) for the purpose for which it is most valuable; (2) in the manner that will secure the greatest efficiency, and (3) as near as possible to the point of production. The most valuable uses for natural gas are for domestic purposes and the development of power.

In the absence of the chairman, the report was presented by William McMab (G. T.). The report was accepted as a progress report without discussion.

SIGNS, FENCES AND CROSSINGS.

The following subjects were assigned:

(1) Continue the investigation of ways and means for securing a proper quality of fence wire to resist corrosion and secure durability.

(2) Report on the relative advantages and disadvantages of the different kinds of fence posts.

(3) Report on the best form of track construction and flangeways at street crossings in paved streets.

(4) Report on the relative advantages and disadvantages of the different kinds of telegraph poles.

The committee decided to devote its attention to the first three subjects assigned, and also to investigate the general subject of miscellaneous signs for railway purposes. A series of questions were prepared for submission to the various railways with a view to determining the practice in vogue at this time and to secure the benefit of data that had been accumulated from experiments made in recent years with various forms of fencing wires, and by various processes, as well as with various kinds of wooden and concrete fence posts. Replies were received from 44 railways of the United States and Canada, representing 61,000 miles of track, which developed the following information:

(1) 28 roads are using woven wire exclusively;
6 roads are using barb wire exclusively;
2 roads are using ribbon wire exclusively;
5 roads are using both barb and woven wire.

Woven wire 49 in. to 55 in. in height appears to be generally used. Specifications in use refer merely to method, form of erection, and style of fence, and give practically no consideration to quality of wire or process of manufacture. The wire companies seem to control this latter feature exclusively. In a couple of cases compliance with the specifications of the American Railway Engineering Association is recommended but not explicitly demanded. Only two of the roads are making any experiments in the development of the subject. Experiments in one case, started April 1, 1909, are being conducted with wires grouped in four classes, as follows:

C. H. STEIN,

Chairman Committee on Signs, Fences and Crossings.

(a) Galvanized after weaving;
(b) Ordinary dip process;
(c) Special galvanized;
(d) Sherardized.

When examination was last made, less than a year ago, (a), galvanized after weaving, was found to be in perfect condition; (b), ordinary dip process, began to corrode during the first year. The corrosion was not so rapid during the second year, but was sufficiently progressive to indicate that deterioration would soon become serious, and the wire go to pieces at points where stay wires were woven around the longitudinal ones; (c), special galvanized, was found to be in excellent condition. No corrosion was apparent, and the wires were still bright. This process is still in an experimental stage, and investigations will be continued. (d), Sherardized. This is a process in which the wire is placed in air-tight receptacles and zinc flue dust packed about it. The receptacles are then heated for a given period of time at a temperature somewhat below the melting point of zinc, the zinc forming a coating over the wires. At the time the test was commenced, this process was not yet far advanced, and later developments may give some promise of success. The results in this case, however, were not good.

Similar tests were commenced under the auspices of the American Society for Testing Materials on the grounds of the Carnegie Technical School, Pittsburg, Pa., on September 26, 1908. The results of these tests will be watched with interest and profit. Several rolling mills are now rolling what is claimed to be a pure metal, running about 99.95 per cent pure iron, and exceedingly low in sulphur, carbon and phosphorus. This is being used for a variety of purposes, and we understand that it can be drawn into wire. This may develop into a proper material for wire making purposes with efficient rust resisting properties.

Copper clad wire is also a form of material that is attracting considerable attention. This consists of a steel core surrounded by a copper jacket applied by mechanical means. The American consul at Birmingham recently called the attention of the State Department of this government to the announcement in a British journal of a new rust-proofing process for iron and steel that is said to be cheap and efficient.

The article to be protected is boiled in a solution whose proportions are: Water, one gallon; phosphoric acid, four ounces, and one ounce of iron filings. This produces a black non-corroding coating that is durable. These different products and methods will be further investigated during the coming year.

It might be stated that English roads use a much heavier wire than those in this country, usually No. 4 to No. 6 gage. All of it is unwiped, and it is said they use a better grade of spelter than we do.

At the present time, undoubtedly the wire galvanized after weaving has proved most durable and efficient, but only certain forms of weaving appear at this writing to be adapted to that process. Progress is being made, however, and if tests now being conducted demonstrate that this is the only manner in which desired results may be obtained, the larger wire mills will discover a means of accomplishing it if the railway companies insist upon it.

(2) Report on the relative advantages and disadvantages of the different kinds of fence posts. Nine roads which replied to circular are beginning to use concrete posts, and we know of others using them, which gave us no information. Experiments have been conducted for too short a period, however, to enable them to make a definite statement as to their durability, economy and efficiency.

The tendency toward the use of concrete posts, however, is becoming very pronounced, and we should in the course of the next year or so be able to secure some very valuable and satisfactory information. The prices for concrete posts appear to vary between 18 and 40 cts., but the figure largely prevailing for the most popular form of post now on the market is 18 to 22 cts. Since the cost of the various kinds of wood posts now in use ranges from 12 cts. to 40 cts., the prevailing cost being 12 to 15 cts., the difference is not so great as to act as a prohibition to the use of concrete. The woods used are necessarily those native to the road and consist of Oregon fir; red, white and Michigan cedar; black, yellow and honey locust; catalpa; tamarack; mulberry, juniper; bois d'arc, chestnut; white and pin oak.

Several forms of metal posts are now being manufactured, and it is claimed by a large manufacturer that they will have a life of at least thirty years and can be delivered at reasonable distances at a price of 23 cts. f. o. b. line of road. These will also receive our attention during the current year, in connection with the further investigation of concrete posts.

(3) Report on the best form of track construction and flangeways at street crossings in paved streets.

The customary practice is the very old one of turning an old light rail on its side and backing it up with wood plank, planking solid with wood or planking next to rail and paving with blocks or brick between. The rail or plank forms the flangeway. Five roads of the forty-four referred to use some special form of rail or flangeway through paved streets. In several of the cases a 141-lb. girder rail is employed with suitable compromise bars at each end to connect to the tee-rail sections. In three cases a special form of rolled filler or flangeway, similar to angle bar construction, with extension beyond the railhead similar to street car flangeways, is being considered and gives promise of successful application. Correspondence is now in progress with the steel company to roll a trial order, and it is hoped the experiment may be made during the course of this year, which would perhaps enable us to make a definite recommendation at the next convention.

(4) Report on the relative advantages and disadvantages of the different kinds of telegraph poles.

This subject was not investigated, as very few experiments have thus far been conducted with this form of construction. The industry is growing, however, and attention will be given it this year.

Signs for railway purposes.—There is a growing demand for uniformity of signs for all railway purposes. It is obvious that it would be a desirable end to be obtained if all signs for use in giving information to the public or employes were of a similar design in all parts of the country. The committee has been investigating the subject with the purpose of producing uniformity, and securing substantial and economic signs, but has not progressed to the point where a conclusion

can be reached. It will recommend the subject for definite recommendations at the next convention.

Much information has been received in regard to the foregoing subjects, but it has not been in a sufficiently substantial form, nor in the nature of such new information, that would warrant the committee in making any recommendations in the shape of conclusions. The various subjects, however, are in a progressive stage, and with the mass of information now at hand it appears that the committee will be enabled at the next convention to put the matters in definite shape.

We have been handicapped very much in failing to secure information from our letters of inquiry. Many roads from whom we expected to get beneficial data have failed entirely to reply to our circulars for information. It is possible that this is due to the fact that there are so many committees of the association reporting on so many different subjects that it is practically impossible for the engineering officers to compile the necessary information and satisfy all of the inquiries. The solution to this problem would, therefore, be that fewer subjects should be assigned for investigation and thus relieve the roads of the great amount of labor that is now necessary in securing and compiling data on the multitude of subjects on which information has been sought during past years.

The matter of a proper quality of fencing wire to resist corrosion and secure durability has been under consideration by the American Society for Testing Materials, and we would, therefore, make the following recommendations:

(1) That the Board of Direction instruct the committee to endeavor to co-operate with a similar committee of the American Society for Testing Materials in reaching a conclusion on this latter subject.

(2) That subjects Nos. 2, 3 and 4, assigned last year, be reassigned for study and a report made when the committee considers that it has sufficient data to warrant conclusions.

(3) That the Board of Direction assign the subject of "Uniform Railway Signs for all purposes as applicable to the Public and to Railway Operation."

The report is signed by C. H. Stein (C. R. R. N. J.), Chairman; A. M. Funk (B. & O.), Vice-Chairman; H. E. Billman (M. P.), G. E. Boyd (D. L. & W.), L. C. Lawton (A. T. & S. F.), E. R. Lewis (M. C.), J. B. Myers (B. & O.), F. M. Patterson (C. B. & Q.), C. H. Splitstone (Erie), W. D. Williams (C. N.).

The report of the committee was received without discussion.

BUILDINGS.

The following subjects were assigned:

(1) Report on the advantages and disadvantages of various types of freight house floor construction.

(2) Continue the study of roof coverings.

(3) Present principles covering the design of inbound and outbound freight houses.

(4) Continue the study of concrete coaling stations.

The committee reports progress on subject (1) Report on the advantages and disadvantages of various types of freight house floor construction.

No recommendations are made as to revision of the manual.

ROOF COVERINGS.

The committee presents as information some miscellaneous corrections and additions to last year's report on roofing. As yet the report is incomplete. The committee had hoped this year to present specifications for coal-tar pitch, but we were unable to offer sufficient inducements to extract the necessary information.

Page numbers refer to the annual report in Vol. 12, Part 1.

Page 589, last paragraph: A single asphalt fluxed by a single oil is ordinarily an imperfect and unsatisfactory roofing material. Like a cut back tar pitch, it lacks stability. The oil is liable to separate out, sometimes supposedly by capillary attraction into the felt, leaving a brittle compound. The successful asphaltic roofing compounds are ordinarily composed of several different materials.

Page 590, last paragraph: Elaterite occurs in Utah in territory near where gilsonite is found, and has much the same appearance, but is found only in narrow veins. Its qualities are considerably different from those of gilsonite, said to be in part due to the presence of considerable sulphur. From it is made a high-priced product which is supposed to be especially valuable as a constituent of the protective coating of ready roofs. We are of the opinion that some products advertising elaterite contain it in only small quantities, if at all.

Page 591, paragraph 2: Rock Asphalt or Mastic Rock.—There is also bitumen saturated limestone of which that found in Uvalde county, Texas, is an example.

Page 591, last paragraph: The first two sentences should be changed to read as follows: "Eastern oils are largely made up of compounds of the paraffine series, which vary in consistency from comparatively thin oil to hard scale paraffine."

There are other members of the paraffine series which are light gases.

Page 592, paragraph 1: The method of distillation of California oils profoundly modifies the character of the residual.

Page 592, paragraph 2: The blown oils are coming to be more appreciated. They can be made into a very uniform product of great value for many purposes, and now that certain patents covering them are expired, their use will probably broaden considerably.

Page 592, paragraph 4: The bitumen in the coal-tar includes, besides the hydrocarbons, other organic compounds, which are, however, present in roofing pitch only in small quantities.

Page 593, last paragraph: Water Gas Tars.—In making carburetted water gas, the procedure is as follows: Steam is blown through a bed of incandescent coal or coke, where it is broken up, forming blue water gas, which consists of about equal quantities of hydrogen and carbon monoxide. This gas, which has no illuminating value, is passed into a second chamber, which is filled with checker brick and which has been previously raised to a high temperature. Into this chamber is sprayed petroleum oil, which, by the intense heat, is broken down into permanent gas and a tar consisting, in the main, of aromatic hydrocarbons similar to those ocurring in coal-tar. This permanent gas is of high illuminating value and imparts its luminosity to the blue water gas, while the tars drop out further on in the process of manufacture. It is from this tar that water gas tar pitch and other products are obtained.

MAURICE COBURN.

Chairman Committee on Buildings.

Water gas tar contains some free carbon, but usually not over two per cent. Its pitch is not acted upon by water. There is a very general opinion among practical roofing men that the water gas tar products are less stable than the coal-tar pitches, but we cannot find that there has been any accurate proof of this. Its small percentage of free carbon materially interferes with its value as a roofing pitch. It is said that carbon can be added, but we doubt the commercial practicability of such a scheme.

Page 596, paragraph 6: Burlap decays much more readily than the average cotton felt.

Page 597, last paragraph: To combat severe conditions encountered like those at locomotive engine houses, instead of the dry sheet, an asphalt or oil-saturated felt is sometimes used. This does not so readily deteriorate. One roofer uses for this purpose asphalt asbestos sheets, which are perhaps better yet.

Page 600, last paragraph: General specifications for an asphalt built-up roof cannot well be prepared because of the differences in materials, and ordinarily must come from the manufacturers of the materials.

The successful laying of an asphalt built-up roof in cold weather is a difficult matter. If the asphalt is hot enough to be properly handled, there is chance of charring the felts. On steep slopes thorough mopping is difficult and there is chance of danger to the men. One of the chief reasons for deterioration of the asphalt is supposed to be gradual absorption, due to capillary action of the flux into the felt.

Page 601, second paragraph: Asbestos Asphalt Built-Up Roofings.—It is claimed that asbestos felt, acting as it does more as a protection to the layers of waterproofing material and not merely as a medium for carrying them, does not have any capillary action on the oil fluxes, and that the bitumen is so protected that it retains its elasticity and waterproofing qualities much longer than with the other types of felt. If this point is sustained, asbestos felts have a superiority for asphalt roofing over the ordinary felts which may more than overbalance the increased costs. While the experience obtained from this material is not nearly as extended as that which has been had from rag felts, these roofings have been in use for about eleven years, and we have so far found nothing to disprove this claim.

The asbestos felt has advantage due to its freedom from action by fire and decay, and it is claimed that the asbestos roofings have a considerable value in their blanketing influence on fires inside the building covered, which the ordinary felts do not have, points the value of which we consider have been overemphasized. The asbestos felt is not in any danger of being charred by hot asphalt which sometimes happens with rag felts.

The asbestos built-up roofings also avoid the gravel or slag necessary with the ordinary "wool" felt built-up roofing. This freedom from the use of gravel or slag with its tendency to roll or be washed off the roof into the gutters would seem to be of some advantage. This also makes it easier to locate a leak and leaves the asbestos roofings much lighter in weight than the other types, an advantage which is probably to some extent offset by the insulating power of the much greater amounts of material used with the "wool" felt. As with all built-up asphalt roofings, difficulties encountered in the mopping make a slope of not more than three inches to the foot desirable.

Tar has not been successfully used with asbestos felts.

As compared with a five-ply tar and gravel roof a four-ply asbestos roof will ordinarily cost at least from one to two dollars more a square. A three-ply roof is supposed to give good results over concrete, but for wood sheathing it would seem to be approaching too closely to the conditions met with in ready roofing, for first class work.

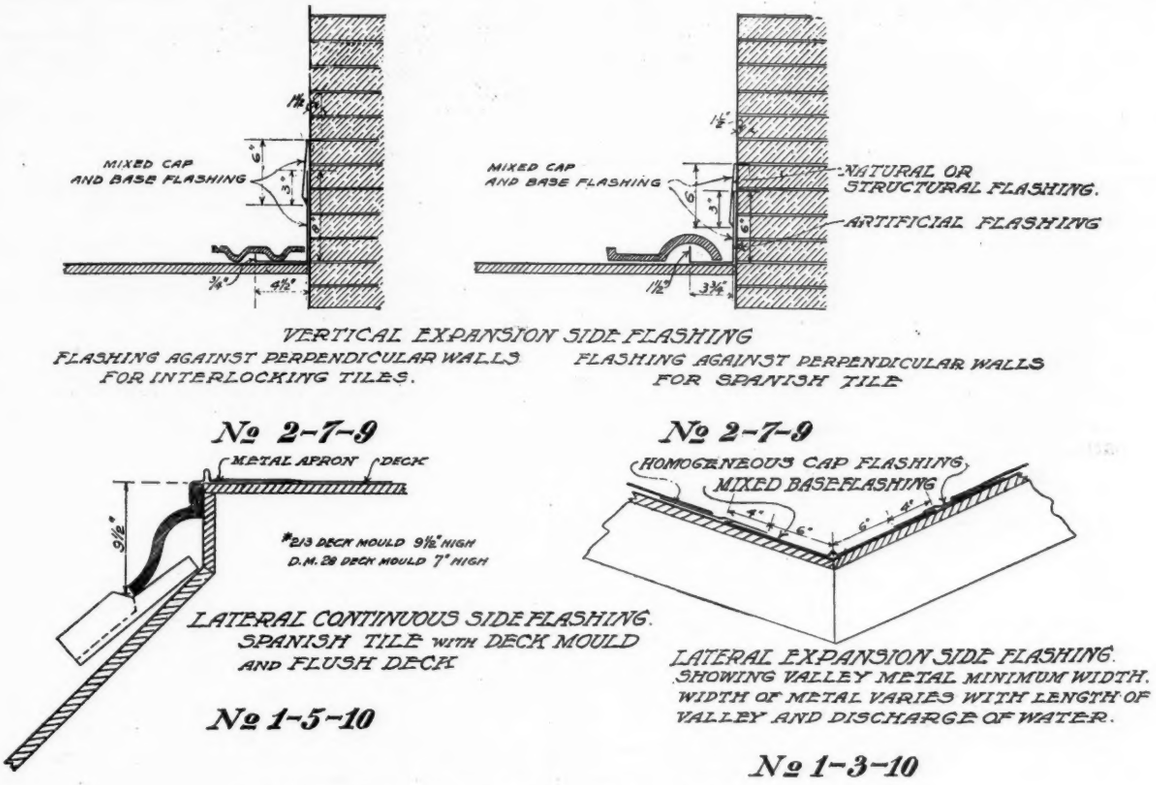
Page 609, paragraph 2: Concrete Roofings.—The Asbestos-Portland cement shingles seem to be gaining ground. The different manufacturers use different methods and the results obtained must be used with caution, as it is claimed that the methods of manufacture have an important bearing on the results which may be expected. Shingles of this type are said to have been successfully used abroad for many years. Recent changes are said to have much improved the quality of the material.

For small buildings, or where the design is such as to make tile undesirable, they have especial advantages. The growing difficulty of obtaining good slate should tend to increase their sale. Their cost is somewhat greater than good slate, but their uniformity is such that they can more successfully be laid French or diagonal method than can slate. A considerable saving can be made by laying them French method, but we do not consider this good practice, especially with large sheets. The material is somewhat brittle and with this method considerably greater amounts of breakage are to be expected, especially on the points. When new, some water may be absorbed, but as they grow older this defect tends to disappear.

The corrugated sheets should have value as a substitute for corrugated iron sheets. They must be laid with good fastenings and sufficient lap to insure against leakage. They must not be nailed. Some of these materials are strengthened by wire mesh and some with perforated steel sheets grading toward the metal protected by asphalt and asbestos.

GUTTERS.

Gutters for many classes of railway buildings may and should be omitted. This is more particularly true of buildings with steep roofs near tracks where cinders from passing locomotives roll down the roof into the gutters and in time, unless more care is taken to keep them clean than is usual in railway buildings, the downspouts become choked and fail to carry off the water.



Details of Flashing and Counter Flashing for Roofs and Walls.

Gutters may be of metal, wood, or be formed in roof of the materials used in the construction of the roof, the latter being ordinarily preferable where the design of the building permits.

Wood gutters are usually of Ogee form on the outside and owing to the thickness of shell the capacity is small for the size of the gutters. They are made in three sizes, 3x4, 4x5 and 4x6. The capacity of these sizes is, however, scarcely more than one-fourth the same size of metal gutters of equal outside dimensions. They are the most durable kind of gutters for buildings exposed to smoke and cinders. They are usually made of fir, white pine or cypress and should be painted inside and out every few years.

Metal gutters are made of copper, galvanized steel, iron, tin or zinc. For permanent buildings, copper is preferable. All joints should be soldered and riveted with not less than four rivets for smaller sizes and should be well braced at least every four feet and proportionately increased in number for larger sizes. The common grades of galvanized steel often

used cannot be depended on for more than two or three years. Some of the refined irons now on the market should be of value for this purpose. Cast-iron gutters are used to a limited extent.

Gutters may be built in the roof, or hanging, as the design of the building requires. Hanging gutters, which are easier to repair, and which do not damage the building if defective, are generally preferable. They should be given as much slope as practicable to the various downspouts and the outer edge of hanging gutters should be low enough to avoid chance of damage by possible backing up of water due to stopped-up gutters and conductor pipes.

Copper gutters should be given a coat of linseed oil and tin gutters a coat of iron oxide paint soon after hanging, and galvanized iron should not be painted until about a year of exposure to the weather unless a special acid treatment is applied to provide a surface which will hold the paint. If a galvanized iron roof is used where copper gutters are applied, care should be taken to insulate or separate the two metals so that galvanic action will be prevented.

FLASHINGS.

The following definitions, together with the diagrams, are presented as information concerning flashings. The numbers accompanying the different diagrams refer to the numbers of the definitions.

(1) Flashings are the mechanical unions between roof surfaces and other parts of the structure intersecting and bounding the plane of the roof, and between roofs in different planes.

(2) Vertical flashings are flashings between roofs and other parts of the structure which intersect the plane of the roof and extend through or above the roof (Examples: Walls, parapets, combings, soil pipes.)

(3) Lateral flashings are flashings between roofs and other parts of the structure which bound the roof or which intersect the plane of the roof without extending above it, or, flashings between roofs in different planes. (Examples: Cornices, eaves, gutters, leader heads, ridges, hips, valleys.)

(4) Head flashings are flashings which are approximately at right angles to the general slope of the roof, at the top of the incline.

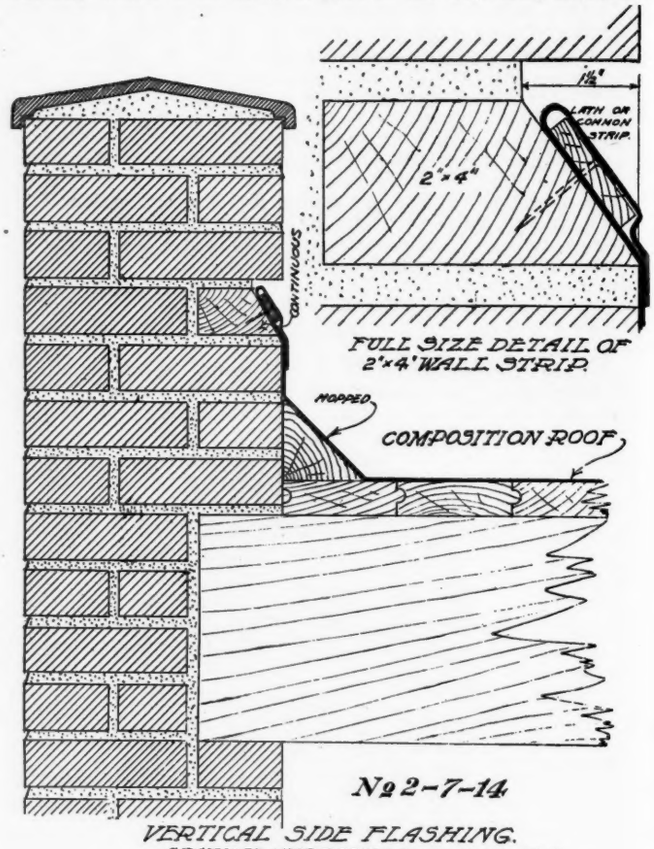
(5) Side flashings are flashings which are approximately parallel to the general slope of the roof.

(6) Foot flashings are flashings which are approximately at right angles to the general slope of the roof, at the foot of the incline.

(7) Expansion flashings are flashings built of two independent parts, each of which is respectively an integral part of the roof, and of the adjoining structure.

(8) Base flashing is that part of an expansion flashing which is an integral part of the roof.

(9) Cap or Counter flashing is that part of an expansion flashing which is an integral part of the adjoining structure.



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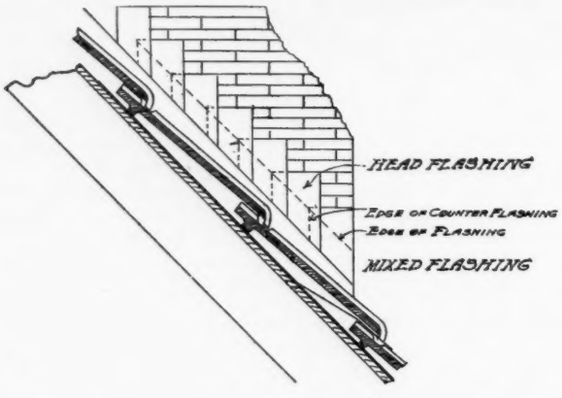
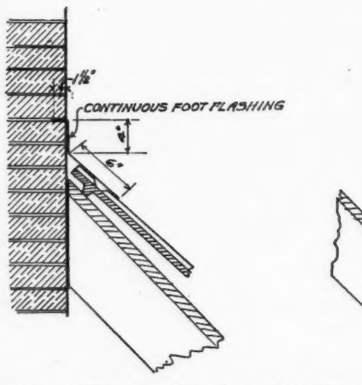
VERTICAL SIDE FLASHING.
SECTION THROUGH WALL FLASHING ON BRICK WALLS

Special Details of Flashing.



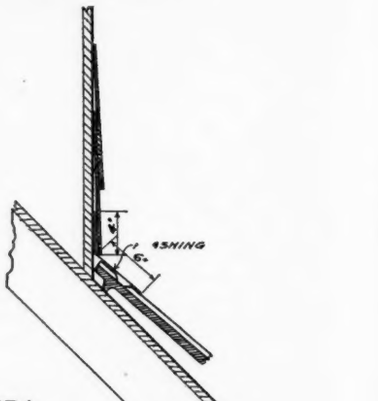
FLASHING AGAINST PERPENDICULAR WALLS FOR INTERLOCKING AND SPANISH TILES

№ 4



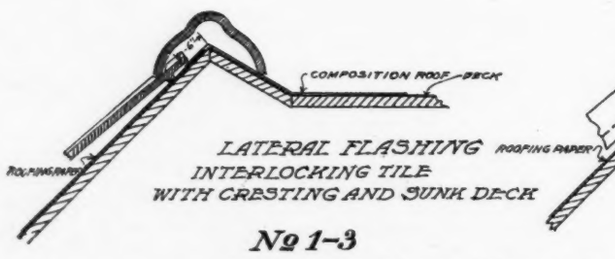
FLASHING AT BASE OF DORMERS AND AGAINST BRICK WALLS

№ 2-10



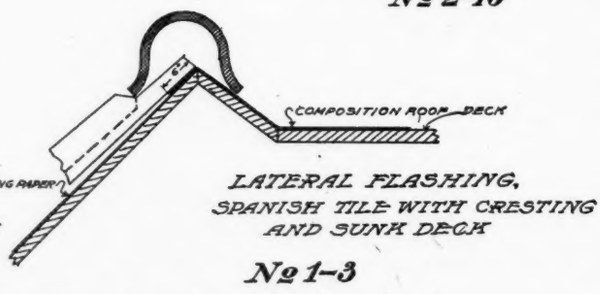
CONTINUOUS FLASHING.
FLASHING AT BASE OF DORMERS IN CONNECTION WITH SIDING TILE

№ 2-10



LATERAL FLASHING
INTERLOCKING TILE
WITH CRESTING AND SUNK DECK

№ 1-3



LATERAL FLASHING.
SPANISH TILE WITH CRESTING AND SUNK DECK

№ 1-3

Details of Flashing and Counter Flashing for Roofs and Walls.

(10) Continuous flashings are flashings which are integral parts of both roof and adjoining structure, without slip or expansion joint.

(11) Protective flashing is that part of a continuous flashing which is an integral part of the adjoining structure, but which does not form an expansion joint with a base flashing.

(12) Homogeneous flashings are flashings built of the same materials as the roof.

(13) Mixed flashings are flashings formed of materials other than materials of the roof. (Examples: A metal base flashing for a felt roof.)

(14) Natural or Structural flashings are flashings which are formed structurally integral with the roof or adjoining structure. (Example: A cap flashing built into a raglet in a parapet wall.)

(15) Artificial flashings are flashings which are not structurally integral with either the roof or the adjoining structure. (Example: A "base" or "continuous" flashing supported upon the adjoining structure by adhesion of materials, or outside cleats.)

The accompanying diagrams are designed to be only illustrative of the distinctions defined above. No effort has been made to formulate recommendations for details of applications of different materials under different conditions.

The report has been signed by Maurice Coburn (Vandalia), Chairman; M. A. Long (B. & O.), Vice-Chairman; G. W. Andrews (B. & O.), W. G. Arn (I. C.), J. P. Canty (B. & M.), O. P. Chamberlain (C. & I. W.), D. R. Collin, C. G. Delo (C. G. W.), W. T. Dorrance (N. Y. C. & H. R.), C. H. Fake (M. R. & B. T.), E. N. Layfield, C. F. W. Felt (A. T. & S. F.).

The report of the committee was received without discussion.

UNIFORM GENERAL CONTRACT FORMS.

The committee was instructed to report on "General Contract Forms."

The text of the report of the 1911 committee was thoroughly discussed and revised, and the reports of the committee on Buildings, published in Bulletin 68, and of the Special Contract committee, made at the tenth annual convention in 1909 and published in Bulletin 108, have been studied. As the report of March, 1911, was not acted upon, the following portion of that report may be repeated:

"The plan of having an agreement form of two pages separate from the general contract conditions and as referred to on page 1176 of the proceedings of the tenth annual convention, is approved by this committee, and the agreement form presented in that report has been reconsidered and revised and is presented here with recommendations for adoption.

"In small or unimportant contracts this agreement form, which is designated as Form A, may be used alone, but in larger contracts the general conditions statement designated as Form B may be inserted, using the agreement form as a folder with the introductory page at the beginning of the contract and the signature at the end.

"Specifications relating to the particular work can either be included in the foller or attached to the back.

"The committee has, in the agreement, made the 'contractor' the party of the first part, and the 'company' the party of the second part, and has, therefore, in preparing the 'general conditions,' placed the provisions relating especially to the duties and rights of the 'contractor' first and those relating to the duties and rights of the 'company' last."

The committee has considered and presents herewith, for discussion, the form suggested for Agreement A, and also the following sections for the General Conditions B:

1. Bond.
2. Contractor's Understanding.
3. Intent of Plans and Specifications.
4. Permits.
5. Protection.
6. Rights of Various Interests.
7. Consent to Transfer.
8. Superintendence.
9. Timely Demand for Points and Instructions.
10. Report Errors and Discrepancies.
11. Preservation of Stakes.
12. Inspection.
13. Defective Work or Material.
14. Insurance.
15. Indemnity.
16. Settlement for Wages.
17. Liens.
18. Work Adjacent to Railroad.
19. Risk.
20. Order and Discipline.
21. Contractor Not to Hire Company's Employes.
22. Intoxicating Liquors Prohibited.
23. Cleaning Up.
24. Engineer and Chief Engineer Defined.
25. Power of Engineer.
26. Adjustment of Dispute.
27. Order of Completion. Use of Completed Portions.
28. Changes.
29. Extra Work.
30. Property and Right of Entry.
31. Unavoidable Delays. Extension of Time on Parts of Work.
32. Suspension of Work.
37. Monthly Estimate.

The committee has discussed, but not formally acted upon, sections 33, 34, 35, 36 and 38.

The committee especially presents for approval:

(1) The general scheme of having the two-page general agreement, Form A, as a folder, within which the other portions of the contract can be bound, thus permitting a concise contract form or a large contract form, according to the requirements of the case.

(2) The Agreement—Form A—as presented herewith.

(3) Sections 1 to 32 and Section 37 of B General Conditions.

For next year's work recommendations are made as follows:

(1) Reconsider standard contract form so far as presented in the light of discussions presented at the convention or by letter.

J. C. IRWIN.

Chairman Committee on Uniform General Contract Forms.

(2) Complete the construction of final sections of contract.

(3) Consider advisability of having any supplementary standard forms in conjunction with Uniform Contract Form, and prepare such contract forms as may be considered advisable.

The report is signed by J. C. Irwin (Rutland), chairman; W. G. Atwood (L. E. & W.), vice-chairman; E. F. Ackerman (L. V.), W. L. Breckinridge (C. B. & Q.), R. G. Kenly (M. & St. L.), E. H. Lee (C. & N. W. I.), C. A. Paquette (C. C. C. & St. L.), H. C. Phillips (A. T. & S. F.), J. H. Roach (L. S. & M. S.), H. A. Woods, (G. T. P.), C. A. Wilson.

CONSTRUCTION CONTRACT.

A.—Agreement.

This Agreement, made this ..... day of ..... in the year .....by and between..... party of the first part, hereinafter called the contractor, and ..... party of the second part, hereinafter called the company.

Witnesseth, That, in consideration of the covenants and agreements hereinafter mentioned, to be performed by the parties hereto and of the payments hereinafter agreed to be made, it is mutually agreed as follows:

The contractor shall furnish all the necessary transportation, materials, superintendence, labor and equipment, and shall execute, construct and finish, in an expeditious, substantial and workmanlike manner, to the satisfaction and acceptance of the chief engineer of the company, in accordance with the plans hereto attached or as herein described, and the following general conditions, requirements and specifications, forming part of this contract.

The work covered by this contract shall be commenced ..... and be completed on or before the ..... day of ....., 191.., ...
.....

And in consideration of the completion of the work described herein, and the fulfillment of all stipulations of this agreement to the satisfaction and acceptance of the chief engineer of the company, the said company shall pay, or cause to be paid, to said contractor, the amount due the contractor, based on the following prices:

.....
.....

This agreement shall inure to the benefit of and be binding upon the legal representatives and successors of the parties respectively.

In Witness Whereof, The parties hereto have executed this agreement in.....the day and year first above written.

Witness:

....
....

CONSTRUCTION CONTRACT.

B—General Conditions.

Bond.

1. The contractor agrees, at the time of the execution and delivery of this contract and before the taking effect of the same, to furnish and deliver to the company a good and sufficient bond of indemnity to the amount of ..... dollars, as security for the faithful performance, by the contractor, of all the covenants and agreements on the part of the contractor contained in this contract. The security in such bond of indemnity must be satisfactory and acceptable to the company.

This bond shall remain in force and effect in such amount, not greater than that specified, as shall be determined by the chief engineer, until the final completion and acceptance of the work.

Contractor's Understanding.

2. It is understood and agreed that the contractor has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work under this contract. No verbal agreement or conversation with any officer, agent or employe of the company, either before or after the execution of this contract, shall affect or modify any of the terms or obligations herein contained.

Intent of Plans and Specifications.

3. All work that may be called for in the specifications and not shown on the plans, or shown on the plans and not called for in the specifications, shall be executed and furnished by the contractor as if described in both these ways; and should any work or material be required which is not denoted in the specifications or plans, either directly or indirectly, but which is nevertheless necessary for the proper carrying out of the obvious intentions thereof, the contractor is to understand the same to be implied and required, and shall perform all such work and furnish any such material as fully as if they were particularly delineated or described.

Permits.

4. Permits of a temporary nature necessary for the prosecution of the work shall be secured by the contractor. Permits for permanent structures or permanent changes in existing facilities shall be secured by the company.

Protection.

5. Whenever the local conditions, laws or ordinances require, the contractor shall furnish and maintain, at his own cost and expense, necessary passageways, guard fences and lights and such other facilities and means of protection as may be required.

Rights of Various Interests.

6. Wherever work being done by company forces or by other contractors is contiguous to work covered by this contract the respective rights of the various interests involved shall be determined by the engineer, to secure the completion of the various portions of the work in general harmony.

Consent to Transfer.

7. The contractor shall not let or transfer this contract or any part thereof (except for the delivery of material) without consent of the chief engineer, given in writing. Such consent does not release or relieve the contractor from any or all of his obligations and liabilities under the contract.

Superintendence.

8. The contractor shall constantly superintend all the work embraced in this contract, in person or by a duly authorized manager acceptable to the company.

Timely Demand for Points and Instructions.

9. The contractor shall not proceed until he has made timely demand upon the engineer for, and has received from him, such points and instructions as may be necessary as the work progresses. The work shall be done in strict conformity with such points and instructions.

Report Errors and Discrepancies.

10. If the contractor, in the course of the work, finds any discrepancy between the plans and the physical conditions of the locality, or any errors in plans or in the layout as given by said points and instructions, it shall be his duty to immediately inform the engineer. Any work done after such discovery, until verified, will be done at the contractor's risk.

Preservation of Stakes.

11. The contractor must carefully preserve bench marks, reference points and stakes, and in case of wilful or careless destruction, he will be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

Inspection.

12. All work and materials shall be at all times open to the inspection, acceptance or rejection of the engineer or his duly authorized representative. The contractor shall at all times provide reasonable and necessary facilities for such inspection.

Defective Work or Material.

13. Any omission or failure on the part of the engineer to disapprove or reject any work or material shall not be construed to be an acceptance of any defective work or material. The contractor shall remove, at his own expense, any work or material condemned by the engineer, and shall rebuild and replace the same without extra charge, and in default thereof the same shall be done by the company at the contractor's expense —or, in case the chief engineer should not consider the defect of sufficient importance to require the contractor to rebuild or replace any important work or material, he shall have power, and is hereby authorized, to make any deduction from the stipulated price that he may deem proper.

Insurance.

14. The contractor shall secure in the name of the company and for its benefit, policies of fire insurance on such structures and in such amounts as shall be specified by the chief engineer not exceeding .....

Indemnity.

15. The contractor shall indemnify and save harmless the company for and from all claims, demands, payments, suits, actions, recoveries and judgments of every nature and description brought or recovered against it, by reason of any act or omission of the said contractor, his agents or employes, in the execution of the work by or in consequence of any negligence or carelessness in guarding the same.

Settlement for Wages.

16. Whenever, in the opinion of the chief engineer, it may be necessary for the progress of the work to secure to any of the employes of the contractor any wages which may then be due them, the company is hereby authorized to pay said employes the amount due them or any lesser amount, and the amount so paid them, as shown by their receipts, shall be deducted from any moneys that may be or become payable to said contractor.

Liens.

17. If an established lien be filed against the contractor for labor or material furnished in the performance of the work, the company is hereby authorized to pay and discharge the same, if it shall deem best so to do, and to deduct the amount so paid from any moneys which may be or become due and payable to the contractor.

Work Adjacent to Railroad.

18. Whenever the work embraced in this contract is near the tracks, structures or buildings of this company or of other roadroads, the contractor shall use proper care and vigilance to avoid injury to persons or property. The work must be so conducted as not to interfere with the movement of trains or other operations of the railroad; or, if in any case such interference be necessary, the contractor shall not proceed until he has first obtained specific authority and directions therefor from the proper officer of the company and has the approval of the engineer.

Risk.

19. The work in every respect shall be at the risk of the contractor until finished and accepted, except damage or injury caused directly by company's agents or employes.

Order and Discipline.

20. The contractor shall at all times enforce strict discipline and good order among his employes, and any employe of the contractor who shall appear to be incompetent, disorderly or intemperate, or in any other way disqualified for or unfaithful to the work entrusted to him, shall be discharged immediately on the request of the engineer, and he shall not again be employed on the work without the engineer's written consent.

Contractor Not to Hire Company's Employes.

21. The contractor shall not employ or hire any of the company's employes without the permission of the engineer.

Intoxicating Liquors Prohibited.

22. The contractor, in so far as his authority extends, shall not permit the sale, distribution or use of any intoxicating liquors upon or adjacent to the work, or allow any such to be brought upon, to or near the line of the railway of the company.

Cleaning Up.

23. The contractor shall, as directed by the engineer, remove from the company's property and from all public and private property, at his own expense, all temporary structures, rubbish and waste materials resulting from his operations.

Engineer and Chief Engineer Defined.

24. Wherever in this contract the word engineer is used, it shall be understood as referring to the chief engineer of the company, acting personally or through an assistant duly authorized in writing for such act by the chief engineer, and wherever the words chief engineer are used it shall be understood as referring to the chief engineer in person, and not to any assistant engineer.

Power of Engineer.

25. The engineer shall have full power to reject or condemn all work or material, which, in his opinion, does not conform to this contract; to direct the application of forcee to any portion of the work which, in his judgment, requires it; to order the force increased or diminished, and to decide every question that may arise between the parties relative to the execution of th work.

Adjustment of Dispute.

26. All questions or controversies which may arise between the contractor and the company, under or in reference to this contract, shall be subject to the decision of the chief engineer, and his decision shall be final and conclusive to both parties.

Order of Completion; Use of Completed Portions.

27. The contractor shall complete any portion or portions of the work in such order of time as the engineer may require. The company shall have the right to take possession of and use any completed or partially completed portions of the work, notwithstanding the time for completing the entire work or such portions may not have expired; but such taking possession and use shall not be deemed an acceptance of the work so taken or used or any part thereof. If such prior use increases the cost of or delays the work, the contractor will be entitled to such extra compensation, or extension of time, as the chief engineer may determine.

Changes.

28. The company shall have the right to make any changes that may be hereafter determined upon, in the nature or dimensions of the work, either before or after its commencement, and such changes shall in no way affect or void this contract. If such changes diminish the quantity or extent of the work to be done, they shall not, under any circumstances, be construed as constituting, and shall not constitute a claim for damages or for anticipated profits on such work.

In case quantities in the completed work vary from the quantities shown on the original plans, and provided for in the specifications, then the final payment shall be adjusted on the basis of unit rates specified in this contract.

Note.—First paragraph of Section 28 to be used in unit price and force account contracts, i. e., in all contracts not on lump-sum prices. Should be omitted in lump-sum contracts.

Extra Work.

29. No bill or claim for extra work or material shall be allowed or paid unless the doing of such extra work or the furnishing of such extra material shall have been authorized in writing by the engineer before any part of such work was done or material furnished.

The price for such work shall be determined by the chief engineer, who may either fix a unit price or a lump-sum price, or may, if he so elects, provide that the price shall be determined by the actual cost, to which shall be added .. per cent. to cover general expense and superintendence, profits, contingencies, use of tools, contractor's risk and liability. If the contractor shall perform any work or furnish any material which is not provided for in this contract, or which was not authorized in writing by the engineer previous to the doing of the work or the furnishing of material, said contractor shall receive no compensation for such work or material so furnished, and does hereby release and discharge the company from any payment therefor.

If the contractor shall proceed with such extra work or the furnishing of such extra material after receiving the written authority therefor, as hereinbefore provided, then such work or material, stated in the written authority of the engineer, shall be covered, governed and controlled by all the terms and provisions of this contract, subject to such prices as may be agreed upon or fixed by the chief engineer.

If the contractor shall decline or fail to perform such work or furnish such extra material as authorized by the engineer in writing, as aforesaid, the company may then arrange for the performance of the work in any manner it may see fit, the same as if this contract had not been executed, and the contractor shall not interfere with such performance of the work.

Property and Right of Entry.

30. The company shall provide the lands upon which the work under this contract is to be done, except that the contractor shall provide land required for the erection of temporary construction facilities and storage of his material, together with right of access to the same.

The contractor shall not enter upon said lands, nor ship any material or equipment, until he has received written notice from the engineer that he may proceed with said work or any part thereof.

Unavoidable Delays; Extension of Time on Parts of Work.

31. If the contractor shall be delayed in the performance of the work from any cause, for which the company is responsible, he shall, upon written application to the chief engineer at the time of such delay, be granted such extension of time as the chief engineer shall deem equitable and just.

Suspension of Work.

32. The company may at any time stop the work, or any part thereof, by giving 10 days' notice to the contractor, in writing. The work shall be resumed by the contractor in 10 days after the date fixed in the written notice from the company to the contractor so to do. The company shall not be held liable for any damages or anticipated profits on account of the work being stopped, or for any work done during the interval of suspension. It will, however, pay the contractor for expense of men and teams necessarily retained during the interval of suspension, provided the contractor can show that it was not reasonably practicable to move these men and teams to other points at which they can be engaged. The company will further pay the contractor for time necessarily lost during such suspension at the rate of .. per cent. per annum on the estimated value of all equipment and fixtures owned by the contractor and employed on the work which are necessarily idle during such suspension, said rate of .. per cent. per annum being understood to include depreciation, interest and insurance. But if the work, or any part thereof, shall be stopped by the notice in writing aforesaid, and if the company does not give notice in writing to the contractor to resume work at a date within ..... of the date fixed in the written notice to suspend, then the contractor may abandon that portion of the work to suspend and he will be entitled to the estimates and payments for such work so abandoned, as provided in Sections ..... of this contract.

Annulment, Contractor's Fault.

33. Discussed, but not acted upon by the committee.

Annulment, Without Fault of Contractor.

34. Discussed, but not acted upon by the committee.

Removal of Equipment in Case of Annulment.

35. Discussed, but not acted upon by the committee.

Measurement and Approval of Work.

36. Discussed, but not acted upon by the committee.

Monthly Estimate.

37. So long as the work herein contracted for is prosecuted in accordance with the provisions of this contract, and with such progress as may be satisfactory to the chief engineer, the said chief engineer will, on or about the first day of each month, make an approximate estimate of the proportionate value of the work done and of material furnished or delivered upon the company's property at the site of the work, up to and including the last day of the previous month. The amount of said estimate, after deducting .. per cent. and all previous

payments, shall be due and payable to the contractor at the office of the treasurer of the company on or about the 20th day of the current month.

Final Estimate.

38. Discussed, but not acted upon by the committee.

Discussion on Uniform General Contract Forms.

In the absence of the chairman, the report was presented by W. G. Atwood (L. E. & W.).

Mr. Atwood: The committee asks the approval of the convention of the general idea of having a short agreement which can be used, when desired, in place of letter agreements, which are very common. If we desire a formal contract instead of the acceptance of the proposition by letter, we would use the agreement which we have shown under Form A. In cases of larger work, where more detail is desired, we propose the general condition shown under Form B, the idea being to print the Form A so that the Form B can be bound in it, together with such other clauses as may be desired by the person using the contract.

J. P. Snow (Con. Eng.): I would like to ask the committee if they feel it is worth while to say that either the contractor or the company is the party of the first part or the party of the second part? It seems to me that the first line or first sentence of an agreement should state what the job is, so that in running over your files you can see what it is that you are trying to find. My preference is to name the work which is to be done—give it a distinctive title—any say that it will hereafter be called "the work."

Mr. Atwood: We have found the practice of naming the parties to the contract as the first and second party is very largely a matter of preference. I have found one or two attorneys who insist that it should be that way. The committee thought this was the better way.

In regard to naming the work in the first portion of an agreement, that could readily be cared for by a heading. A blank is provided below the next clause for a description of the work. That is on the first page of the contract.

C. Frank Allen (Mass. Inst. Tech.): In all contracts there must be definitely two parties. Sometimes the description of one of the parties is somewhat elaborate, and if there is a clear distinction made between those two parties, the contract, on the whole, is somewhat clearer, and I believe that a distinction by the use of "party of the first part" and "party of the second part" does more fully establish who the two parties are. It does not impress me as unnecessarily encumbering the contract, and it does add somewhat to its clearness.

Mr. Atwood: This clause reads, "party of the first part, hereinafter called 'the contractor,' and blank, party of the second part, hereinafter called 'the company.'" In the clauses in Form B the two parties to the contract are spoken of in that way.

Mr. Baldwin: What do you gain by naming them as parties of the first part and second part if you don't refer to them that way in the contract? They are referred to as "contractor" and "the railway company."

Mr. Atwood: That is a legal form and some of the lawyers consider it necessary. I don't know whether there is any legal objection to withdrawing "party of the first part" and "party of the second part" from this one clause or not, but it doesn't seem to me there is any objection to leaving it there.

Mr. Baldwin: I move that in the third line "party of the first part" be eliminated, and in the fourth line "party of the second part" be eliminated."

Mr. Stein: I think there should be some specific designation similar to the one outlined by the committee. I believe that almost from time immemorial there has been a substantial form in which the contracts have been gotten up, and it frequently happens that the names of contracting parties are so much alike that even we who are familiar with the general character of the contract, but not entirely familiar with the specifications of it, are obliged to be very careful in reading the contract in order to fully understand what obligations rest upon the respective parties. In my own experience when it has been referred to as "party of the first part" and "party of the second part," I would be obliged to refer to the indication in the preamble to the contract to distinctly understand what particular person was obligated by that particular specification. If names so nearly alike had simply been mentioned it would have been almost impossible and would have made us prone to error in a proper interpretation of the contract. For that reason, I believe, if this paper, as prepared by the committee, was submitted to the legal departments of the railways, they would direct that the contract be prepared just in the form that has been arranged for by the committee. I think the committee's report should stand. If the association thinks there is any question as to the propriety of this contract, it had better be submitted to the legal department of some of the railways and get their advice in the matter before the association arbitrarily says, "cut this thing out."

The motion was lost by a rising vote.

J. B. Berry (C., R. I. & P.): I suggest the committee leave a blank line or two after the description of the parties—there are frequently three or more parties to any contract, and I think the necessary space should be left for the insertion of three, four or five names if necessary.

E. A. Frink (S. A. L.): The last clause of the argument reads, "In witness whereof the parties hereto have executed this agreement in ..... the day and year first above written." It seems to me that date is incorrect, for the reason that a contract is made and completed on the day when the proposition has been accepted, but need not necessarily be signed until some time thereafter. Instead of that clause referring to the date first above written, which appears at the head of the contract, it seems to me it should show the date when the contract was actually signed.

Mr. Raymer: The contract has the usual form in saying "in accordance with the plans hereto attached." We know that is an idle form, because in most of the railway contracts it is impossible to attach the plans to the contract, and I think a different form should be arranged, for instance: "In accordance with the plans identified by the signatures of the parties hereto."

Mr. Atwood: In regard to the criticism of the last clause, there is a misprint. The word "in" should be "on." It is my opinion that the contract does not become in force and effective until it is signed. In fact, a contract supersedes any prior agreement, verbal or written. The contract is supposed to embody all such agreements, and it does not seem to me the last clause should be changed as suggested.

In regard to Mr. Raymer's criticism, it is, of course, a fact that sometimes the complete plans are not attached to the contract, but that is covered by the words, "or as herein described." If the plans are not attached the description of the work would necessarily embody the plans that would be required to cover the entire work.

Mr. Raymer: In work of any magnitude the plans are completed at the time of the letting of the contract. It is frequently necessary, however, to make changes in the plans during the progress of the work by agreement with the contractor, and the original plans referred to in the contract should be specifically marked in some way so as to form part of the contract, and for that reason it is desirable to have the plans referred to in the contract, and identified by the signatures of the parties to the contract.

I move that the phraseology now contained in the report, "in accordance with the plans hereto attached," or "as herein described," be changed to read as follows: "In accordance with plans identified by the signatures of the parties hereto."

The motion was lost.

Mr. Atwood: I move that the first recommendation of the committee that the form of construction contract A, as presented, be approved.

Motion carried.

The President: We will now take up the Construction Contract B, General Conditions.

Mr. Morse: What is intended to be meant by the words, "to furnish and deliver to the company a good and sufficient bond?" Would not it be well to say the treasurer of the company in referring to the railway company?

Mr. Atwood: That practice varies with different companies. In the case of some companies the chief engineer controls it, in some cases the treasurer, in some cases the legal department, and in some cases all three.

Mr. Lindsay: What is the object of making the distinction between "permits of a temporary nature" and "permits for permanent structures"? It seems to me the line is hazy and might lead to confusion unless the committee has some special object in making the distinction.

Mr. Atwood: The committee has already boiled down some clauses bearing on this matter which were much longer. It is intended that the contractor shall obtain permits for such work, for instance, as the opening of a street, or the erection of scaffolding or similar temporary work, while it is intended that it shall be the duty of the company to secure permits in such cases as the permanent change of grade or the position of a sewer or water pipe. Anything that is of a permanent character will be cared for by the company, and if it is a temporary obstruction it will be the duty of the contractor to secure the permit.

Mr. Steffens: The last sentence of Section 13 is pretty radical. It gives the chief engineer authority to make any deduction from the stipulated price that he may deem proper for defective work. Unless there is an arbitration clause later which I have not seen, that is pretty dangerous from

the contractor's standpoint. I think "as agreed upon by the parties" would be acceptable reading.

Mr. Atwood: It is unusual, I think, in contracts to permit the chief engineer to accept work that is not up to specifications. I think all of us have had experiences where we have condemned work and ordered it torn out when we felt it was not up to specifications, but would perhaps have performed its service. This paragraph leaves an opportunity to use the work and allow a deduction. I do not believe it is practicable to make that a matter of agreement.

Mr. McDonald: I ask the committee if they intend the word "Employes" in the second line of clause 16 to mean also "sub-contractors?"

Mr. Atwood: I think that was the intention of the committee.

Mr. Raymer: Referring to Section 17, it is customary in Pennsylvania to have a "no lien" clause. The law requires a copy of the contract and some additional information to be filed at the County Court House, after which the company is not responsible for liens. I ask the committee if there is any objection against having a "no lien" clause included in this contract?

Mr. Atwood: It seems to the committee that such cases as might occur under various state laws would be special cases that the road using the contract would have to cover in a special clause.

Mr. Steffens: It seems to me an arbitration clause should be inserted between Sections 26 and 27. This clause makes the chief engineer the sole judge of all disputes, and an arbitration clause very often saves us from annoying lawsuits.

W. I. Trench (B. & O.): I have prepared an addition to paragraph 27 to meet a condition I have lately encountered, a case in which a contractor failed to properly locate his plant in the beginning, failed to remove it in time to avoid delay in the work, and failed to remove portions of his plant after completion of parts of the work, which seriously delayed another portion of the work to be done by the company. I move that an addition be made to paragraph 27, as follows:

"The contractor shall locate his plant only after careful study of the plans, and consultation with the engineer in charge, so as not to interfere with any work to be performed by the company during his occupation of the premises. If, to facilitate the work, temporary location has been permitted, the contractor shall immediately upon demand of the engineer remove such plant or portion of plant at his own expense. If the contractor fails to make said removal, the company may do it at his expense. The contractor shall remove the plant from finished portions of the work immediately on demand of the engineer in charge. If he shall fail to make such removal, it may be done by the company at his expense."

The above addition was put to vote, but was not adopted.

Mr. Greiner: It seems to me that the last part of the second paragraph of Section 29 is rather hard on the contractor. Conditions may arise where the contractor is compelled to do some work not covered in the contract, in order to protect his work. It may be necessary to do that at a time in advance of notice from the engineer, and as this paragraph reads, he would get no pay for it at all.

Mr. Atwood: The committee has felt that it is necessary to draw this contract as rigidly as it is drawn. The engineer is an arbitrator and he is supposed to be fair to both parties. The final determination in any case would go to the courts if there was a disagreement, and we feel we have covered this matter of extra work as fairly to both parties as it is possible to do it and protect both parties. An unfair engineer can, of course, by the arbitrary enforcement of certain clauses of a contract work great hardships.

Mr. Greiner: The engineer will have no authority at all on this point. If the contractor was performing any work, or furnishing any material, which was not provided for in the contract, or authorized in writing by the engineer, previous to the doing of the work, or the furnishing of the material, the contractor would receive no compensation for such work or material. If the contractor does work not called for in the contract, he should be paid for it, provided the engineer shall see fit to authorize it in writing, even after it is started. According to the language used in this section, the engineer has no right to authorize it, after the work is started, even if it is absolutely necessary.

Mr. Jenkins: I think the clause as it stands deters the contractor in some cases from doing necessary extra work in the absence of the engineer, because he might be afraid he would not get the proper authorization, even after the work is done, and might be afraid that authorization, if issued, would not enable him to collect any money.

L. C. Fritch: I think Mr. Greiner's point can be covered if we leave out the words "previous to the doing of the work or the furnishing of material."

Mr. Lindsay: In the third paragraph of the same section, it would be necessary to eliminate the words "after receiving the written authority therefor."

Mr. Atwood: The committee will accept the amendment.

Mr. Lindsay: I would like to ask if it is necessary to put in the words "in sections," near the bottom of paragraph 32? Would it not be better to read, "as provided in this contract"?

Mr. Baldwin: This clause, as drawn, leaves latitude for a great deal of dispute between the contractor and the engineer as to the value or amount of the time that is lost. We have made it a practice to name the price per day that should be charged for teams under those circumstances, and require the contractor to make it part of his contract, and likewise specify that payment would be made for men on monthly time only. To a certain extent this precludes the contractor from bringing in an excessive claim.

G. D. Swingly (B. & O.): It is my idea that the contractor should be paid for teams which are necessarily idle on account of temporary stoppage of the work, but it seems to me that we might name a time limit, because it might be necessary to hold up the work for a considerable period of time and give the contractor a very good chance to keep his men and teams there at our expense, and if he did not have any other contracts it might be more profitable for him to keep his men and teams there and not try to get them away.

Mr. Baldwin: We cover that by naming a price that barely more than lets the contractor out, with both men and teams. The result is he is after the engineer to get started.

Mr. Frink (S. A. L.): Referring to Section 37, we have found it saves a good deal of trouble if we require the contractor before the first monthly payment, to file with us a schedule of prices for material on specified price contracts and material on lump sum contracts. Then, in making up the estimates, the inspector on the ground makes up an estimate of the work done, makes up a regular form showing his estimate. That is examined by the contractor, or the contractor's foreman, and if it is satisfactory, it is signed by both parties and sent to the home office for payment. In that way we avoid all discussion with the contractor about whether he has or has not been allowed as much as he ought to be allowed.

Mr. Berry: I would like to ask the committee whether the members have consulted with their law departments in regard to the bond and the contracts.

Mr. Atwood: The New York Central Lines' members of the committee have, and we have, found that in various states that various roads' law departments disagree about the same thing. There are, undoubtedly, things in this contract which some law departments will not approve and will change, but I do not believe it possible to draw a general contract of this kind that will satisfy all law departments.

Mr. Fritch: I believe that before we vote on the adoption of this, it ought to be referred for a legal opinion. There are five clauses which were discussed, but not acted upon by the committee. It seems to me it would be proper to receive this as information and have the committee report next year. In the meantime, many of us can use this form, but we should get a final opinion on it for next year.

Mr. Fritch: I move that the report of the committee be received as information and referred back to the committee for final report next year.

Motion carried.

ECONOMICS OF RAILWAY LOCATION.

The committe realizes that some of the members of the association may be disappointed in its failure to produce a report having some logical conclusions. The failure to report at the 1911 convention was explained at the time, but during the past year the committee has been greatly encouraged in its work by the receipt of considerable valuable operating information.

Under date of October 26, 1911, the chairman was able to send to such members of the committee as had shown any interest in the work a tabulated statement by accounts of the operating costs of nine large railways, comprising 13 per cent of the main track mileage of the United States, over 18 per cent of the freight train mileage, and over 16 per cent of the passenger train mileage. In some cases the more important accounts covering "Conducting Transportation" were separated between passenger and freight service, which will be of particular value to the committee in the final analysis of the questions to be considered.

In addition to the cost data, information has been tabulated covering the density of traffic per mile of main track in train miles, car miles and ton miles.

The working members of the committee have been devoting such time as they could spare to the study of the statistics

tabulated, and to a portion of them it becomes apparent that no fixed values can be established for distance, curvature, rise and fall, or gradient. A careful study of the data covering costs by primary accounts apparently indicates that costs in some of the accounts vary with the number of train miles and the ratio of freight train mileage to passenger train mileage.

In other cases the logical unit of variation is the ton mile, or car mile depending entirely on the account in question. Further, the density of traffic both as to train mileage and ton mileage enters into the costs.

The result is that the committee has refrained from presenting any conclusions for your consideration until it has had time to thoroughly digest the information now at hand.

A portion of the committee believes that each case must be considered by itself, with a probability that the values used for the unit costs will vary widely, depending on local conditions of traffic with reference to car loading, character and density of traffic, etc., and in some cases on climatic conditions.

A. K. SHURTLEFF,

Chairman Committee on Economics of Railway Location.

The committee hopes to present a report during the coming year which will show one or more methods of practical analysis of the question covering conditions that exist with each case.

The report is signed by A. K. Shurtleff (C. R. I. & P.), Chairman; R. N. Begien (B. & O.), Vice-Chairman; C. Frank Allen (M. I. T.), Willard Beahan (L. S. & M. S.), C. K. Conard (Erie), A. C. Dennis, C. P. Howard (I. C.), W. A. James (C. P. R.), Fred Lavis (Consulting Eng.), C. J. Parker (N. Y. C. & H. R.), F. W. Smith (C. C. C. & St. L.), Francis Lee Stuart (B. & O.), Walter Loring Webb (Consulting Eng.), M. A. Zook (C. G. W.).

The committee report was received without discussion.

GRADING OF LUMBER.

The committee wishes to re-submit the definitions of defects and lumber grading rules submitted in its report last year, with certain slight changes, indicated below. It believes that they fairly represent specifications for maintenance of way lumber as it can be purchased in the market to-day. The rules submitted may not suit all conditions. It is pointed out, however, that the acceptance of these rules by the association, with a provision that individual grades can be departed from where the requirements of any particular road seem to make it necessary, will represent a great step forward in bringing about uniform rules for the grading of lumber. It appears to the committee that slight differences of opinion, concerning one or more grades, should not interfere with the acceptance of these rules in a general way.

The rules as submitted last year have been changed so as to bring them into harmony with those already published in the manual. The descriptions and definitions of defects are in accord with those already adopted by the association as standard. There have been added this year "Grading Rules for Cypress Lumber."

RECOMMENDATIONS.

The committee recommends that the lumber grading rules as presented last year, subject to the corrections and including the additions made below, be adopted as standard.

The following is a list and reference to the proceedings where the data included in these recommendations can be found:

(1) Classification and Grading Rules for Douglas Fir (pp. 548-555, Vol. 12, Part 3, 1911 Proceedings).

(2) Specifications for Douglas Fir Structural Timbers. (Substitute for paragraphs 38-51, inclusive, pp. 556, 557, Vol. 12, Part 3 of the Proceedings, the specifications for Douglas Fir Bridge and Trestle Timbers, as given on pp. 143 and 144 of the manual for 1911. For paragraphs 54 and 55, page 557, Vol. 12, Part 3 of the Proceedings, substitute paragraphs 1, 2, 3, 6 and 7, as given on page 145 of the manual for 1911).

(3) Classification, Grading and Dressing Rules for Northern Pine, including White and Norway Pine and Hemlock (pp. 565, 577, Vol. 12, Part 3, 1911 Proceedings).

(4) Classification, Grading and Dressing Rules for Southern Yellow Pine (pp. 578-600, Vol. 12, Part 3, Proceedings, 1911). (For paragraphs 43-59, inclusive, substitute paragraphs 1-14, inclusive, as given on pp. 141 and 142 of the manual for 1911.)

HERMAN VON SCHRENCK.

Chairman Committee on Grading of Lumber.

(5) Standard Specifications for Construction Oak Timbers (pp. 601-606, Vol. 12, Part 3 of the 1911 Proceedings).

(6) Classification and Grading Rules for Cypress Lumber and Shingles, presented in this report.

The report is signed by Dr. Hermann von Schrenk (Rock Island Lines), Chairman; B. A. Wood (M. & O.), Vice-Chairman; D. Fairchild (N. P.), R. Koehler (S. F.), A. J. Neafie (D. L. & W.), W. H. Norris (M. C.), F. B. Walker (N. P.), C. W. Richey (P. R. R.).

APPENDIX E.

Classification and Grading Rules for Cypress Lumber and Shingles.

General Instructions.

Cypress lumber shall be graded according to the following rules and specifications, bearing in mind that as no arbitrary set of rules and specifications can be maintained in every case, much must be left to the common-sense and best judgment of the inspector:

1. Lumber shall be manufactured and shipped in standard lengths and thicknesses.

2. Tank, 1st and 2d and worked partition shall be graded from the poorer side.

3. Select lumber, flooring, ceiling, bevel siding and finishing shall be graded from better or finished side, but the reverse side should in no case be more than one grade lower.

4. All lumber shall be tallied surface or face measure, the tally counted up, and the one-quarter or one-half added to the total where the lumber is one and one-quarter or one and one-half inches thick, and 2 in. and thicker to be multiplied by the thickness.

5. In the measurement of all lumber, fractions exactly on the one-half foot are to be given alternately to the buyer and the seller; the fractions below the one-half foot are to be dropped, and all fractions above the one-half foot are to be counted to the next higher figure on the board rule.

6. In "line boards," pieces 14 ft. and longer shall be given the advantage in grade; pieces 12 ft. and shorter shall be reduced in grade.

7. Recognized defects in cypress are knots, knot holes, shake, splits, wane, worm holes, stained sap and peck.

Standard Defects.

8. A standard knot is sound and not to exceed 1¼ in. in diameter.

9. A small sound knot is one not exxceeding ¾ in. in diameter.

10. Two small knots not to exceed in extent or damage one 1¼ in. knot.

11. One straight split not to exceed in length the width of the piece.

12. Worm, grub, knot and rafting pin holes not exceeding in damage one 1¼ in. knot.

13. Ordinary seasoned checks shall not be considered a defect in any grade.

14. Ordinary season checks are such as occur in lumber properly covered on yard, or season checks of equal size in kiln dried lumber.

15. Bright sap is not a defect in select or below.

16. Pin worm holes, sound knots and stained sap shall not be considered a defect in No. 1 barn or below.

Standard Lengths.

17. All random standard length stock may be furnished in odd as well as even foot lengths, but there shall not be to exceed 20 per cent of odd lengths in any one item.

18. Tank stock and No. 1 barn shall be 8 ft. and longer.

19. 1st and 2d and select shall be 10 to 20 ft.

20. Finish, flooring, ceiling, partition, bevel and drop siding shall be 10 to 20 ft.

Pecky Cypress.

21. Moldings and battens of all sizes 6 to 20 ft., in both odd and even foot lengths, but not exceeding 10 per cent of 6, 7, 8 and 9 ft. lengths.

22. No. 2 barn, 6 ft. and longer.

23. Cull or peck, 4 ft. and longer.

Standard Finished Sizes of Cypress.

24. All lumber shipped in the rough (except 8/4 in. No. 1 and No. 2 "Dimension," which grades may be ¼-in. under or ¼ in. over the size specified, both in thickness and width) shall be of sufficient thickness to S2S to standard thickness, as follows:

25. 4/4 lumber S1S or S2S shall be $\frac{13}{16}$ in. thick.

26. 5/4 select, 1st and 2d clear, selected common tank and tank lumber S1S or S2S, shall be 1⅛ in. thick.

27. 5/4 peck, No. 1 and No. 2 barn and finishing lumber S1S or S2S, shall be $1\frac{1}{16}$ in. thick.

28. 6/4 select, 1st and 2d clear, selected common tank and tank lumber S1S or S2S, shall be 1⅜ in. thick.

29. 6/4 peck, No. 1 and No. 2 barn and finishing lumber S1S or S2S shall be $1\frac{5}{16}$ in. thick.

30. 8/4 lumber, except No. 1 and No. 2 barn or dimension S1S or S2S, shall be 1¾ in. thick.

31. 8/4 No. 1 and No. 2 barn or dimension S1S or S2S shall be 1⅝ in. thick.

32. 10/4 lumber S1S or S2S shall be 2¼ in. thick.

33. 12/4 lumber S1S or S2S shall be 2¾ in. thick.

34. All lumber S1E takes off ⅜ in. S2E, ½ in.

35. All flooring shall be S2S and C. M.

36. 4/4 flooring shall be $\frac{13}{16}$ in. by 2¼ in., 3¼ in., 4¼ in., 5¼ in. face.

37. 5/4 flooring shall be $1\frac{1}{16}$, 6/4 shall be $1\frac{5}{16}$, by same widths as 4/4.

38. ⅜ ceiling shall be worked $\frac{5}{16}$ in., S1S only.

39. ½ ceiling shall be worked $\frac{7}{16}$ in., S1S only.

40. ⅝ ceiling shall be worked $\frac{9}{16}$ in., S1S only.

41. ¾ ceiling shall be worked $\frac{11}{16}$ in., S1S only.

42. All widths of ceiling to be the same as flooring, unless otherwise specified. Ceiling up to 3¼ in. face to have one bead on one edge and ceiling wider than 3¼ in. face to be beaded center and edge.

43. Partition to be finished the same as ceiling, but on both faces.

44. Drop siding shall be worked ¾ in. by 3¼ in., 4¼ in., 5¼ in., 7¼ in., 9¼ in. face, S2S and C. M. or shiplapped.

45. Bevel siding or bevel cribbing shall be worked ½ in. less in width than the rough strip measure.

Tank Stock.

46. This grade shall be random widths, and will not be furnished in specified widths, and shall be graded from the poorer side.

47. This grade shall be 5 in. and wider, 1½ in. to 4 in. thick and 8 ft. and over in length. Pieces up to 7 in. shall be free from sap. Pieces 7 in. to 13 in. may have 1 in. of sound sap on one edge, not to exceed half the length and half the thickness of the piece. Pieces 14 in. and wider may have 1 in. of sound sap on both edges, not to exceed half the length and half the thickness of the piece. In all widths sound knots that do not impair usefulness for tank purposes may be admitted.

First and Second Clear.

48. This grade shall be random widths, and will not be furnished in specified widths, and shall be graded from the poorer side.

49. This grade shall be 8 in. and wider, 1 in. to 4 in. thick and 10 ft. and over in length. Pieces 8 in. to 10 in. may have 1 in. of bright sap on each edge, or its equivalent on one or both edges, otherwise they must be clear. Pieces 10 in. and under 12 in. may have 1½ in. of bright sap on each edge or 3 in. on one edge, and may have one standard knot or its equivalent. Pieces 12 in. wide may have 2 in. of bright sap on each edge, or 4 in. on one edge and may have one standard knot; or, in lieu of sap, may have two standard knots or their equivalent. Pieces wider than 12 in. may admit of defects as specified above in proportion as width increases. Pieces 10 in. and wider may admit of one end split, which shall not exceed in length the width of the piece. Pieces 12 in. and less in width, free from other defects, may have bright sap across one face at one end, but this sap shall not exceed in length one-tenth of the length of the piece. In pieces 13 in. and wider bright sap is not a defect.

Selects.

50. This grade shall be random widths, and will not be furnished in specified widths, and shall be graded from the better side, but the reverse side shall not be of a lower grade than No. 1 shop or No. 1 barn.

51. This grade shall be 7 in. and wider, but will not be furnished wider than 12 in.; shall be 1 in. to 4 in. thick, 10 ft. and longer. Pieces 10 in. and under in width shall admit two standard knots or their equivalent and an additional standard knot or its equivalent for every 2 in. in width over 10 in. Pieces free from other defects, 10 in. and over in width, to admit pin worm holes on one edge one-tenth the width of the piece. Bright sap is not a defect in this grade. Slight wane on pieces 10 in. and over in width is allowed on one edge not over 3 ft. in length. When no other defect appears, slight amount of stained sap may be allowed. Pieces 10 in. and wider may admit of one end split, which shall not exceed in length the width of the piece.

Selected Common Tank Stock.

52. This grade shall be 4 in. wide, or wider, 1½ in. and 2 in. thick, 8 ft. and over in length. Sound sap no defect in this grade, but must be free from unsound knots or other defects that extend through the thickness of the piece, and must be square edged to work the full length of the piece.

No. 1 Barn or Dimension.

53. This grade shall be specified widths only, shall be 3 in. and wider, 1 in. and thicker, 8 ft. and over in length, admitting sap, bright or stained, shake, season checks, knots, pin worm holes, a small amount of peck on one side and one edge, or very slight peck on both sides and both edges of pieces comparatively free from coarse defects; which defects, however, shall not be sufficient to seriously impair the strength, or prevent the use of each piece for "common" purposes in its full length and full width.

No. 2 Barn or Dimension.

54. This grade shall be specified widths, 3 in. and wider, 1 in. and thicker, 6 ft. and over in length, admitting all the defects allowed in No. 1 barn, but same may be larger and coarser, and in addition will admit pick on both sides; however, the defect shall not be sufficient to prevent the use of each piece in full length and full width for low-grade fencing and other very common purposes.

Cull or Peck.

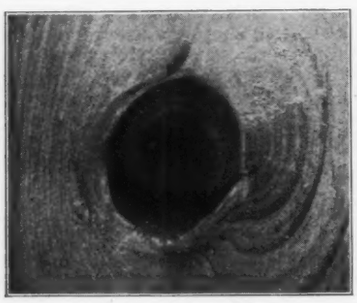
55. This grade may be random or specified widths 3 in. and wider, 1 in. to 4 in. thick, 4 ft. and over in length. Shall admit all pieces below the grade of No. 2 boxing, and shall also admit the product of that part of the log known as "pecky;" however, each piece shall have sufficient strength and nailing surface to permit its use as a low grade boxing, crating, sheathing and foundation material.

Finishing.

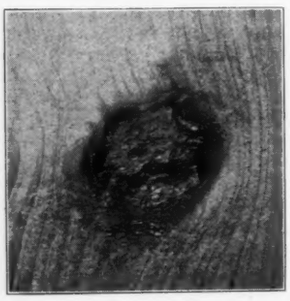
56. Shall be specified widths 4 in. and wider, 1 in. to 2 in. thick, 10 ft. and over long, and shall be graded from the better side, A, B and C, but the reverse side should not be more than one grade lower. All grades of finish, rough or S1S or S2S may vary ¼ in. from the width specified.

57. "A" Finish.—Pieces 4 in. and 5 in. wide shall be clear of sap, knots and other defects. Pieces 6 in. wide may have 1 in. of bright sap, or in lieu of sap one small sound knot. Pieces 7 in. and 8 in. wide may have 2 in. of bright sap, or in lieu of sap one small sound knot. Pieces 9 in. and 10 in. wide may have 3 in. of bright sap, or in lieu of sap two small sound knots, or 1½ in. of bright sap and one small sound knot. Pieces 12 in. wide may have 4 in. of bright sap, or in lieu of sap one standard knot, or two small sound knots, or 2 in. of bright sap and one small sound knot. Pieces 14 in. or wider may have more defects in proportion as the width increases.

58. "B" Finish.—Pieces 4 in., 5 in. and 6 in. wide may have 2 in. of bright sap and one or two small sound knots, or in lieu of knots may have all bright sap. Pieces 7 in. and 8 in. wide may have 3 in. of bright sap and two small sound knots, or in lieu of knots may have all bright sap. Pieces 9 in. and 10 in. wide may have 4 in. of bright sap and one standard knot or three small sound knots, or in lieu of knots may have all bright sap. Pieces 12 in. wide may have 6 in. of bright sap and one standard or four small sound knots, or in lieu of knots may have all bright sap. This grade will not be furnished wider than 12 in.



Standard Sound Knot.



Rotten Knot.

59. "C" Finish.—All widths in this grade shall admit small sound knots, stained sap, pin worms and other defects except shake; but none that will prevent the use of same in its full width and length as a paint grade, and will admit pieces containing one coarse defect which can be removed by making two cuts with a waste of not to exceed 5 per cent in the one piece removed, but which pieces are otherwise "B" grade or better. This grade will not be furnished wider than 12 in.

60. "D" Finish.—All widths will admit sound knots, stained sap, pin worms, slight shakes, and other defects; but none that will prevent the use of same in its full width and length as a common paint grade. This grade will not be furnished wider than 12 in.

Siding.

61. Siding shall be 4 in. and 6 in. in width, 10 ft. to 20 ft. in length, and graded from the finished side, A, B, C and D.

62. "A" Siding.—May have 1 in. of bright sap on thin edge, and may contain one small sound knot.

63. "B" Siding.—May have any amount of bright sap, or if not all bright sap, may have three small sound knots, shake, split or pin worm holes not exceeding in damage the three small knots as above, and may have slight wane on the thin edge. In the absence of other defects a small amount of stained sap will be permitted.

64. "C" Siding.—May have one to five knots, the whole not aggregating over 3 in. in diameter, or knots, splits or other defects that can be removed in two cuts with waste not exceeding 10 per cent of the length, or may have small amount of stained sap and pin worm holes not exceeding in damage the five small knots above described.

65. "D" Siding.—May have stained sap and pin worm holes, or may have other defects that will not cause a waste to exceed one-third the piece.

Flooring and Ceiling.

66. Shall be specified widths, 10 ft. to 20 ft. in length and graded from the finished side, or if both sides are finished, it shall be graded from the better side, A, B, C and D.

67. "A"—May have bright sap on one edge one-fourth its width, otherwise must be clear.

68. "B"—May have one-half of its face bright sap if otherwise clear, or in lieu of sap, may contain two small sound knots, or may have a split not to exceed 9 in. at one end.

69. "C" (10 to 20 ft.)—May have all bright sap, or may have one to five knots, the whole not aggregating over 3 in., or knots or other defects that can be removed in two cuts with waste not exceeding 10 per cent of the length, or may have three pin worm holes, or may have check or split at one end, not to exceed 10 per cent of the length.

70. "C" (4 to 9 ft.)—May have all bright sap, small sound knots, stained sap, pin worm holes and other defects except shake, but none that will prevent the use of each piece the full length.

71. "D"—May have stained sap and pin worm holes, or may have unsound knots or other defects that will not cause a waste to exceed one-third the piece.

Partition.

72. Shall be same widths and lengths as flooring and ceiling, but shall be graded from the poorer side, A, B, C and D, same grading to apply as in flooring and ceiling.

Pickets.

73. Shall be graded No. 1 and No. 2.

74. 1 in. by 1 in. shall be headed and S4S to 13/16 in. by 13/16 in.

75. 1¼ in. by 1¼ in. shall be headed and S4S to 1 1/16 in. by 1 1/16 in.

76. 1½ in. by 1½ in. shall be headed and S4S to 1 5/16 in. by 1 5/16 in.

77. 1 in. by 3 in. shall be headed and S4S to ¾ in. by 2½ in.

78. No. 1.—Shall be well manufactured, bright sap, no defect and may contain one small sound knot.

79. No. 2.—Shall admit stained sap, sound knots, pin worm holes, slight shake, and pickets thrown out of the No. 1 grade because of poor manufacture.

Battens.

80. Battens, both flat and O. G., are not moldings. Same are invariably used with "common" lumber and shall, therefore, be graded No. 1 barn and better, admitting all defects allowed in No. 1 barn, but none that will prevent the use of each piece in full length for batten purposes. ⅜ in. battens shall be 1 in. strips S2S to $\frac{13}{16}$ in. by 2½ in. and resawed, or 1 in. by 2¾ in. to 3 in. S2S and resawed. Unless otherwise specified, ⅜ in. or flat battens shall be S2S only and resawed.

81. O. G. battens shall be manufactured in the sizes and pattern shown in the Universal Molding Book.

Car Roofing and Siding.

82. "C and Better" Grade.—This grade will admit sound knots, stained sap, pin worm holes, very slight shake and other defects, but none that will prevent the use of each piece in its full width and length for car roofing and car siding; may be random or specified lengths and may be worked to pattern specified and graded from pattern side or S2S and C. M. and graded from the better side.

Car Lining.

83. Shall be specified widths and 8 to 20 ft. in length. Will admit tight knots, stained sap, pin worm holes, slight shake and other defects, but none that will prevent the use of each piece in its full width and length for car-lining purposes.

Shingles.

84. Bests.—A dimension shingle, 4, 5, and 6 in. in width, 16 in. long, each width packed separately, 5 butts to measure 2 in., to be all heart and free of shake, knots and other defects.

85. Primes.—A dimension shingle, 4, 5 and 6 in. in width, 16 in. long, each width packed separately, 5 butts to measure 2 in., admitting tight knots and sap, but free of shake and other defects, but with no knots within 8 in. of the butts.

86. This grade may contain shingles clipped two-thirds of the width and one-eighth of the length on the point.

87. Star a Star.—A random width shingle 3 in. and wider, 14 in. to 16 in. long, otherwise the same as primes.

88. Economy.—Dimensions 4, 5 and 6 in., each width separately bunched, admitting sap and sound knots, may have slight peck 5 in. from butts, imperfections on points no objection and admitting 14 in. shingles.

89. Clippers.—All shingles below the above grades which are sound for 5 in. from the butts, worm holes and slight peck excepted, random widths 2½ in. and wider.

90. The count of our manufacture of shingles, of all grades,

is based on 4,000 linear inches in width, making 1,000 standard shingles, consequently there would be only 667 6-in. shingles packed and counted as 1,000 standard shingles; 5 in. dimension being counted in like proportion.

91. In making re-inspections of shingles, one bundle out of 20 bundles taken at random shall be cut open, the results of this investigation to form the basis of arriving at the grade of the entire shipment.

Discussion on Grading of Lumber.

Dr. von Schrenk: At the time this report was submitted, it was thought it would probably be printed sufficiently far in advance of the convention to give the members a chance to criticize the rules submitted. As the report has only been out a short time, I suggest that, in adopting these lumber grading rules, the sixth reference be omitted.

Appendices A, B, C and D, published last year, and amended by this year's report, were voted on separately, and all were adopted. Appendix E was received as information.

WOOD PRESERVATION.

The subjects assigned were as follows:

(1) Continue investigation of the proper grouping of the different timbers for antiseptic treatment.

(2) Compile available information from service tests.

(3) Investigate the merits of various preservatives, giving special attention to oil from water gas tar and to the use of refined coal-tar in creosote oil.

EARL STIMSON.

Chairman Committee on Wood Preservation.

(4) Report on the advisability of revising the adopted specifications for creosote oil.

(5) Recommend forms for the inspection of preservative processes.

(6) Present specifications for impregnation with creosote oil.

(7) Report on the value of impregnation with crude oil.

(8) Report on the value of brush coating and dipping.

(1) GROUPING OF TIMBERS FOR ANTISEPTIC TREATMENT.

The Sub-Committee on Grouping was instructed to continue the investigations of the proper grouping of timbers for antiseptic treatment. Last year arrangements were made for a series of co-operative experiments at several plants to determine the best method of grouping various species in different regions. These tests have not been completed, but some progress has been made, the results of which are submitted as appendix "A" to this report. During the coming year additional experimental work will be done at several plants. This will be systematized, so that uniform results will be obtained and as definite a basis as possible established for grouping under representative conditions.

Considerable time must elapse before the experimental work will be brought to a point where final conclusions can be drawn. Past experience, however, has demonstrated certain fundamental facts in relation to grouping, and it is recommended that such principles as have received recognition in standard practice be embodied in the manual. These fundamentals can be elaborated upon in the future as additional information becomes available.

The principles recommended at the present time for insertion in the manual are as follows:

(a) Ties of approximately the same period of seasoning should be grouped together for treatment; green ties should never be mixed with seasoned ones.

(b) Pine ties should be separated on the basis of heartwood and sapwood; it would also be advisable in some cases to group hardwoods on the same basis, but it is not generally practical to do so.

(c) Grouping on the basis of species and families, as, for example, red oaks, pines, beeches, etc., if a further division into hardwood classes is made with pine, is usually a satisfactory practice. From this it follows that red oak, beech, long-leaf pine, loblolly pine and gum should be treated separately. Birch and hard maples and certain other combinations, depending on the locality, can be grouped together to advantage.

(d) The separation in the yard, on the basis the ties are to be grouped for treatment, is an essential and economical practice.

(2) The recommendations of the report of the committee for 1911 included the recommendation that certain sections of track be selected on each railway for the purpose of making accurate tests covering the life of treated and untreated ties. To ascertain the extent to which this had been done in the past, and the results which have been obtained, the committee sent out a circular letter, the replies to which are abstracted in appendix "B" to this report.

(3) The committee was directed to give special attention to the merits of oil from water gas tar and to the use of refined coal-tar in creosote oil. Sufficient information has not been obtained to enable report to be made on these subjects at this time. The investigations will be continued the coming year.

(4) REVISION OF THE ADOPTEO SPECIFICATIONS FOR CREOSOTE OIL.

After careful consideration it seems desirable to change the first clause in the adopted specifications for creosote oil to provide that it shall be a pure product from coal gas tar or coke oven tar and free from any foreign admixture, including coal gas tar or coke oven tar. With this change, the specification for standard creosote oil will read as follows:

The oil used shall be the best obtainable grade of coal-tar creosote; that is, it shall be a pure product obtained from coal gas tar or coke oven tar and shall be free from any tar, oil or residue obtained from petroleum or any other source, including coal gas tar or coke oven tar; it shall be completely liquid at 38 deg. centigrade and shall be free from suspended matter; the specific gravity of the oil at 38 deg. centigrade shall be at least 1.03. When distilled by the common method—that is, using an eight-ounce retort, asbestos covered, with standard thermometer, bulb one-half inch above the surface of the oil—the creosote, calculated on the basis of the dry oil, shall give no distillate below 200 deg. centigrade, not more than five per cent. below 210 deg. centigrade, not more than 25 per cent. below 235 deg. centigrade, and the residue above 355 deg. centigrade, if it exceeds five per cent. in quantity, shall be soft. The oil shall not contain more than three per cent. water.

In addition to the standard grade, two inferior grades can be used in cases where the higher grade oil cannot be procured. It should be understood that where it is necessary to purchase grades No. 2 and No. 3 consideration should be given to the use of a greater quantity of creosote oil per cubic foot. The following specification is for the No. 2 grade:

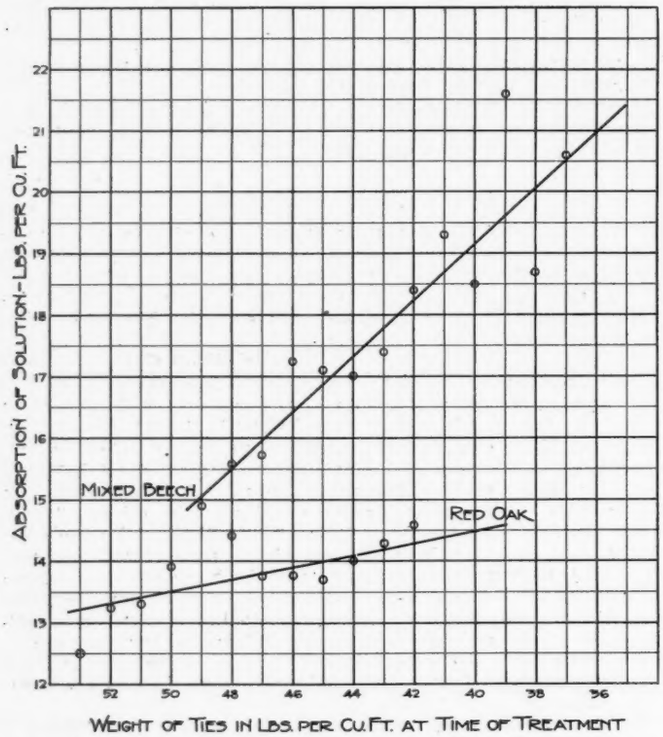
The oil used shall be the best obtainable grade of coal-tar creosote; that is, it shall be a pure product obtained from coal gas tar or coke oven tar, and shall be free from any tar, oil or residue obtained from petroleum or any other source, including coal gas tar or coke oven tar; it shall be completely liquid at 38 deg. centigrade and shall be free from suspended matter; the specific gravity of the oil at 38 deg. centigrade shall be at least 1.03. When distilled by the common method—that is, using an eight-ounce retort, asbestos covered, with standard thermometer, bulb one-half inch above the surface of the oil—the creosote, calculated on the basis of the dry oil, shall give not more than eight per cent. distillate below 210 deg. centigrade, not more than 35 per cent. below 235 deg. centigrade, and the residue above 355 deg. centigrade, if it exceeds five per cent. in quantity, shall be soft. The oil shall not contain more than three per cent. water.

The following is the specification for the No. 3 grade:

The oil shall be the best obtainable grade of coal-tar creosote; that is, it shall be a pure product obtained from coal gas tar or coke oven tar and shall be free from any tar, oil or residue obtained from petroleum or any other source, in-

cluding coal gas tar or coke oven tar; it shall be completely liquid at 38 deg. centigrade and shall be free from suspended matter; the specific gravity of the oil at 38 deg. centigrade shall be at least 1.025. When distilled by the common method—that is, using an eight-ounce retort, asbestos covered, with standard thermometer, bulb one-half inch above the surface of the oil—the creosote, calculated on the basis of the dry oil, shall give not more than 10 per cent. distillate below 210 deg. centigrade, not more than 40 per cent. below 235 deg. centigrade, and the residue above 355 deg. centigrade, if it exceeds five per cent. in quantity, shall be soft. The oil shall not contain more than three per cent. water.

No change is recommended at this time in the "Specifications for Analysis of Creosote Oil," except that this heading should be changed to read "Specifications for the Fractionation of Creosote Oil." This specification merely covers the fractionation and does not cover the chemical analysis which would be necessary in order to determine the presence of adulteration. The determination in regard to adulterants can be made chemically in several manners with the same results, and there does not, therefore, seem to be the necessity for preparing a complete specification covering chemical analysis that there is for preparing the specification covering the fractionation, the latter giving different results when made by different methods.



Absorption of Red Oak and Mixed Beech Ties at Various Treating Weights, Per Cubic Foot, by the Card Process.

For the purpose of obtaining more information in regard to the relative merits of the flask and retort for the fractionation of creosote oil, and also for the purpose of obtaining other information on which to base further consideration of the specification for fractionation, it has been arranged that various samples of creosote oil be submitted to the various railways for analysis by various methods, the reports obtained being submitted in writing to the committee as soon as possible for action by the committee next year.

(5) It is found that the various railway and timber-treating companies have their own forms for the inspection and recording of the various preservative processes, each meeting their own peculiar conditions, although similar in the essential details. The committee is not now prepared to submit a report on this subject, but will continue its consideration the coming year.

(6) A specification for impregnation with creosote oil has already been adopted by the association and is contained in the manual. It is the sense of the committee that this specification is in accordance with good practice, and no change is recommended.

(7) The committee is not in position to report at this time and recommends the continuance of the subject for the coming year.

(8) A circular letter was sent out making inquiry as to these methods of treatment. Out of 38 replies, 31 report that neither process has been used, and seven report that no definite conclusions can be drawn from their experience. It is recommended that further consideration be given this subject.

CONCLUSIONS.

It is recommended:

(1) That the four principles of grouping of timbers, as given under subhead (1), grouping of timbers for antiseptic treatment, be accepted for insertion in the manual.

(2) That the revised standard specifications for creosote oil, and the specifications for No. 2 grade and No. 3 grade creosote oil, as given under subhead (4), revision of adopted specifications for creosote oil, be adopted.

(3) That the heading "Specifications for Analysis of Creosote Oil," as it now stands in the manual, be changed to read as follows: "Specifications for the Fractionation of Creosote Oil."

OUTLINE OF WORK FOR 1912.

The committee recommends:

(1) Continue investigations of the merits as a preservative of oil from water gas and the use of refined coal-tar in creosote oil.

(2) Continue the compilation of available information from service tests.

(3) Continue the investigation of the proper grouping of the different timbers for antiseptic treatment.

(4) Continue consideration of the revision of the specifications for fractionation of creosote oil.

(5) Report on the value of impregnation with crude oil.

(6) Report on the value of brush coating and dipping.

(7) Report on methods of accurately determining the absorption of creosote oil, including check of gage readings and the keeping of corrected records.

(8) That the Board of Direction assign the work of drawing up a standard specification for timber for treatment to a joint committee of the committee on Wood Preservation and the committee on Grading of Lumber.

The report is signed by Earl Stimson (B. & O.), Chairman; E. H. Bowser (I. C.), Vice-Chairman; G. M. Davidson (C. & & N.-W.), H. B. Dick (B. & O. S. W.), W. W. Drinker (Erie), Dr. W. K. Hatt (Purdue Univ.), V. K. Hendricks (S. L. & S. F.), George E. Rex (A. T. & S. F.), E. A. Sterling (Consulting Eng.), C. M. Taylor (C. R. R. of N. J.), Dr. H. von Schrenk (Rock Island Lines), Charles Yoder (L. S. & M. S.), C. E. Knickerbocker.

APPENDIX A.

Grouping of Timbers for Antiseptic Treatment.

Chicago Tie and Timber Preserving Company.—The information furnished by this company covers the treatment of red oak and mixed beech ties by the Card process. The weights as given in the table are not taken from selected lots, but cover the daily practice. The cubical contents in each charge was estimated by displacement. The computations from the daily log sheets were made by the Forest Products laboratory:

Oak—Card Process.			Beech (mixed)—Card Process (includes gum, elm, basswood, etc.)		
Weight per cu. ft. Pounds	Absorption per cu. ft. Pounds	No. Ties used	Weight per cu. ft. Pounds	Absorption per cu. ft. Pounds	No. Ties used
42	14.6	2,670	37	20.6	567
43	14.3	7,516	38	18.7	1,723
44	14.6	19,472	39	21.6	571
45	13.7	32,727	40	18.5	2,818
46	13.8	32,498	41	19.3	1,707
47	13.8	10,323	42	18.4	3,972
48	14.4	1,569	43	17.4	1,702
49			44	17.0	5,114
50	13.9	1,113	45	17.1	3,414
51	13.3	2,228	46	17.2	3,982
52	13.2	1,668	47	15.7	4,027
53	12.5	2,308	48	15.6	4,553
			49	14.9	2,313
Total		114,092	Total		36,463

The table and accompanying diagram show clearly that the absorption per cu. ft. with both mixed beech and red oak ties falls off as the treating weights of the ties increase. Thus the absorption of red oak at 42 lbs. per cu. ft. is about 14½ lbs. of solution, and at 53 lbs. per cu. ft. about 12½ lbs. For mixed beech the difference is even more marked, varying from about 21 lbs. of solution at 37 lbs. per cu. ft. to 15 lbs. absorption at a treating weight of 49 lbs. per cu. ft.

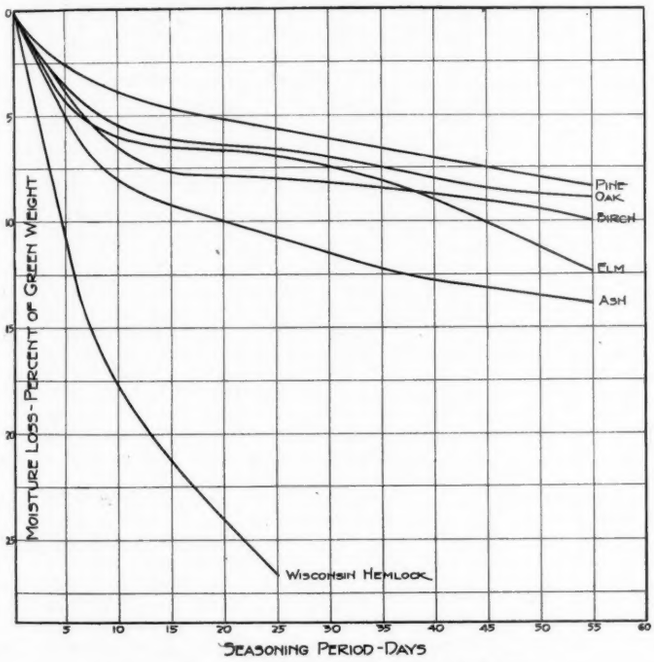
Northern Pacific.—The report submitted concerns the sea-

soning and treatment of pine, oak, beech, elm, ash and hemlock crossties at the Paradise, Mont., plant of the Northern Pacific. The data were compiled by the Forest Products laboratory.

Two ties of each of the above species, with the exception of the birch and hemlock, of which four ties were used, were piled to air-season in a shed where the air was artificially heated. All were hewn ties 7 in. by 9 in. by 8 ft. and contained an average of sapwood for Minnesota timber. The ties were weighed from time to time to ascertain the rate at which they were seasoning; Fig. 1, in the accompanying diagram, showing graphically the results obtained. After the ties had seasoned to the minimum weight shown in the figure they were placed in the treating cylinder and given a Lowry treatment, all being treated in exactly the same manner. Fig. 2 shows the amount of creosote absorbed by the ties under these conditions. Just before treatment the ties had the following weights:

Pine	110.50 lbs.
Oak	164.25 "
Birch	153.50 "
Elm	135.75 "
Ash	126.00 "
Wisconsin hemlock	168.00 "

Of special note is the rate at which hemlock seasoned, as compared with the other woods, and the large amount of oil



Rates of Air Seasoning of Untreated Ties.

absorbed by the ash ties as compared with those cut from oak and hemlock, it being approximately four times as great.

Pennsylvania Railroad.—At the Mt. Union and Greenwich plants of the Pennsylvania Railroad definite experiments are under way to determine the length of time to season the different species handled, the results from various methods of piling and the period of seasoning which will give the best results from the standpoint of treatment. As the experiments have not been in progress long enough to arrive at a definite solution of the several points, it will only be possible at this time to outline the nature of the work.

The experiments at the two plants are to be identical in character, the tests at Mt. Union to be made with beech, maple and red oak and at Greenwich with beech, red oak, black gum and sap pine.

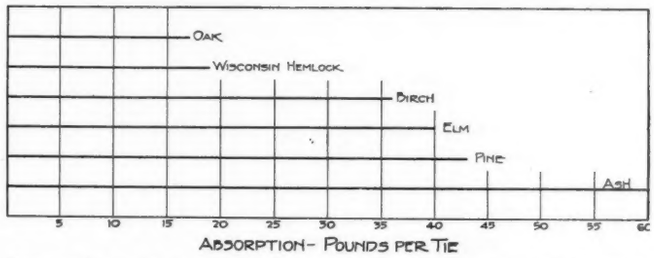
Two definite lines of experiments are under way. In the first 24 ties of each species are to be weighed and piled 7x1, and at the end of each month two ties of each kind will be weighed and treated. This work was started in April, 1911, but another series will be conducted later to determine the influence of climatic conditions in different seasons of the year. The data eventually produced should indicate the rapidity with which each species seasons and show after what period of seasoning the treatment is most effective.

The second line of experiments will be a comparison of the 7x7 with the 7x1 piling systems, and of open blocks as compared with solid ones. In this test a whole block (six piles square) of oak ties at Mt. Union were piled solid 7x7; adjoining this was a block of ties 7x7, but with 2-foot alleys between each two rows of piles; while another adjoining block was piled according to the company's present system, with the 7x1 arrangement in the piles, 2-ft. alleys between each two tiers of piles and 4-ft. alleys between the blocks. In each of these experimental blocks a large number of ties has been weighed, marked and placed in various places in the different piles; yet in each block the marked ties will be in approximately the same position. These ties are to be left for 8 or 9 months, and just before treatment the marked ties will be weighed and the comparative rates of seasoning noted.

Texas Tie and Lumber Preserving Company.—This company reports that the grouping and seasoning of pine ties, as described, is in connection with the Rueping empty-cell process.

"We have carried the segregation of pine timber a little further than is customary when we can do so and have tried to separate, when possible, ties that had more than 50 per cent. sapwood from those that had less and treated them in different charges. Our ties at Somerville are also divided approximately 50 per cent. hewn and 50 per cent. sawn, and of our sawn ties we get approximately 65 per cent. heartwood ties with very little sap, and of our hewn ties we get only about 10 per cent. of long-leaf ties, which have very little sapwood on.

"In treating ties with the Rueping process we find, for instance, that we have to put in from 10 to 15 pounds more air in the sawn tie that are 65 per cent. heartwood than we do in the hewn ties that are only 10 per cent. long leaf, with small sapwood to leave in the same amount of oil at the finish of the treatment. We also find when we separate the hewn ties in saps and hearts that we have to make about



Absorption of Creosote (Lowry Process) of Air-Seasoned Ties.

15 lbs. difference in the air to leave in the amount of oil when the tie is treated. This is about the extent of our findings on this subject, and it may not be of interest to those not using the Rueping process."

Discussion on Wood Preservation.

Mr. Stimson: We will consider the four recommended principles for the grouping of timbers, which are presented for adoption by the association, for insertion in the manual.

Mr. McDonald: There seems to be a tendency on the part of the committee to confine its activity entirely to ties. Should not the first clause in the first principle refer to something else besides ties? I think it is just as important to group dimension timber as ties.

Mr. Stimson: This particular grouping applies more particularly to ties than to longer timbers. The bulk of the timber treating is confined to ties, from a railway standpoint. We can widen the scope of our recommendations and substitute the word "timbers" for "ties," if that is what the association wants.

The four principles included under subhead (1), "Grouping of Timbers," were voted on separately and all were adopted.

The change in the standard specifications for creosote oil recommended in Conclusion 2 was adopted without discussion.

Mr. Stimson: There seems to be a demand for a specification for creosote oil somewhat less stringent than our standard specification. In fact, it seems necessary to have such a specification to meet the grade of oil that we are oftentimes obliged to purchase. I move the adoption of the specification for a No. 2 grade creosote oil.

Mr. Fritch: What will be the difference in the cost between specifications No. 2 and No. 3?

Mr. Stimson: That is a matter, more or less, of market price. We are very seldom able to get a creosote oil that conforms strictly to the standard specification. Still, the

inference is that you pay for a high-grade oil. We would place a modified specification in the hands of the purchasing agent, and if he cannot get it according to the standard specification, it will meet one or the other of the modified specifications, with some hope that there might be some modification in price.

Mr. Fritch: I think three grades are too many. Two, in most cases, are enough. It seems to me we should insist upon the very best grade of creosote oil. I realize at times it is difficult to secure the first grade, but it seems to me the third grade is too low for us to accept. A slight difference in the grade of the oil will seriously affect the treatment, while the difference in the cost will be very slight.

Victor K. Hendricks (St. L. & S. F.): Some of the roads are getting a grade of creosote that will not come under No. 2 and will come under No. 3, and they have to have the creosote, and that was the reason the third grade was recommended by the committee.

W. L. Seddon (S. A. L.): The question of the price is not so much one of the difference in cost of the oil, as of the action of the low-grade oils in preserving the timber. Before we recommend No. 2 and No. 3 oil specifications, we ought to have some information as to the effect of such oils on the timber.

Mr. Stimson: Most of us are now using No. 2 or No. 3 oil and get very good results.

Dr. von Schrenk: I have always advocated the use of strictly No. 1 high-grade specification oil on account of the desirability of getting the very best that we can possibly find. The committee finds, however, that for several years, owing to the tremendous increase in the creosoting industry in this country, and owing to the absence of a sufficient high-grade supply, a great many railways are buying oil under our standard specifications, which, as a matter of fact, does not meet the requirements.

The committee pointed out that in using specifications 2 and 3, consideration should be given to the use of greater quantities of creosote oil per cubic foot of wood than would be used if specification No. 1 was used.

Mr. Frink: I understand the known sources of supply of first-class oil are not utilized. Enormous amounts go to waste every year in this country. If there were a demand for that No. 1 grade, I think the supply would soon fill it.

Mr. Lindsay: Is it practicable to refine the No. 2 and No. 3 grades up to the standard of No. 1?

Dr. von Schrenk: No, sir; if that were the case, we would insist absolutely on No. 1.

S. B. Fisher (M. K. & T.): I think we should have the lower grades of creosote. The indications are that soft ties will wear out before they decay, and we may have to get cheaper grades of creosote to preserve those ties before they wear out.

Mr. Coombs: It may be perfectly proper to use a cheaper grade of oil for a cheaper class of work, and I would suggest that the committee might properly advise the relative ultimate cost in the work of the different grades, taking into account the larger quantity of the cheaper grades.

A vote on the motion for the adoption of the specification for No. 2 oil showed 83 votes in the affirmative and 7 in the negative.

Mr. Stimson: I move the adoption of the specification for the third grade creosote oil.

C. H. Spencer (Wash. Ter. Co.): I wish to amend that motion to the effect that the specification for No. 3 oil be referred back to the committee for further consideration and report as to quality and values of the creosote specified.

Mr. Fritch: In seconding the amendment I would like to say that many of us are treating our timber with all the oil we can get into it. How are you going to get more oil of the lower grades into the timber? I question whether it is not possible to refine the lower grade oil into higher grades. There is a commercial condition which we must meet, and I do not think we are prepared to meet it now. We have not enough light on the subject and we are simply asking for a little more time so that the subject may be thoroughly investigated.

Mr. Webb: The question involved here is like the question of buying different grades of lumber. We would all like to use the highest grade A1 lumber, but we cannot. We do not recommend that any railway shall use this third grade of creosote oil, but we simply define what the third grade of creosote oil shall be.

Mr. Seddon: We do know comparatively something about the comparative life and usefulness of various grades of lumber, and we would be willing to consider various grades of creosote oil if we knew something about them.

Mr. Stimson: We are not prepared to state how many cents less per gallon the different grades of oil No. 2 and No. 3 will cost as compared with No. 1, or how many years, more or less, the ties which are treated with No. 2 and No. 3 oil will last. It must be determined by practical experience, and no doubt many of the best results obtained on railways in creosoting are obtained with the use not only of the standard grade, but of the No. 2 and No. 3 grade of creosote oil.

L. G. Curtis (B. & O.): The only way we can tell as to what the No. 1 grade is worth, what the No. 2 grade is worth, and what the No. 3 grade is worth is to adopt the specifications and then try them out.

C. E. Lindsay: As I understand it, the difference between specification No. 2 and specification No. 3 is only a small percentage in specific gravity; one is 1.03 and the other 1.25. What percentage of the total output of creosote oil would be rejected if we did not have No. 3 specification?

Dr. von Schrenk: That is almost impossible to answer, because the volume of oils differ from week to week and month to month, depending on peculiar accidents which occur in the distilling operation. The only reason why a very small difference is made in the specifications is simply to give an actual specification for the actual oil we find the railways are buying in millions of gallons every week. Oils of the character of grades No. 2 and 3 have been used for from 75 to 100 years. All we are doing is to endeavor to get an opportunity for some of the oils to be used with positive recommendations concerning their use.

S. R. Church: (Barrett Mfg. Co.): There is really no essential difference between the three grades of oil which the committee has recommended. They are all pure coal tar creosotes. The reputation of coal tar creosote as a preservative both abroad and in this country was established before any oil that was of high specific gravity, or with as high distillation range as your standard specification requires, was produced or was in use in large quantities.

The question has been raised as to whether it is possible to refine any of the oils of lower distillation range to make them comply with specification No. 1. That could be done, but only at the loss of some creosote oil increasing, the cost of the preservative.

It is not true that there is any surplus of oil material in this country from which creosote oil can be obtained. The amount of tar going to waste is very negligible. The manufacturers are doing everything in their power to get the highest possible percentage of creosote and the best possible quality of creosote from the tar. We are continually endeavoring to obtain enlarged outlets for the by-product which results in the manufacture of high grade creosote, and I feel safe in saying that the average quality of the creosote will improve with time. I also feel safe in saying that the average quality of the creosote produced to-day is of proven value and the timbers treated with enough of the preservative of any of these three oils may cause no anxiety as to their life.

The amendment to the motion for adoption instructing for recommittal was voted on and lost.

The motion to adopt the recommendation of the committee covering No. 3 grade creosote oil was carried.

Mr. Stimson: I move the adoption of the third conclusion of the committee "That the heading 'Specifications for Analysis of Creosote Oil,' as it now stands in the manual, be changed to read as follows: 'Specifications for the Fractionation of Creosote Oil.'" Motion carried.

J. B. Berry: I would suggest action by the members of this Association on the following resolution:

"Resolved, By the members of the A. R. E. A. in convention assembled, that we desire to place on record our hearty appreciation of the efforts made and the admirable results obtained by the Railway Age Gazette in its daily issue during this convention.

CONCLUDING BUSINESS OF THE CONVENTION.

Resolutions were unanimously adopted expressing appreciation of the efforts made and the results obtained by the Railway Age Gazette and the Railway and Engineering Review in publishing daily editions during the convention.

A resolution was unanimously adopted in appreciation of the efforts made by the National Railway Appliance Association in making possible the instructive exhibit of devices and materials used in the construction, operation and maintenance of railways.

Resolutions were unanimously adopted expressing appreciation of the work of the Committee on Arrangements and of the retiring president. The convention adjourned.

The most important railway in German East Africa is the Dar-Es-Salam Morogoro-Tobora, of which 285 miles have been opened to traffic and 465 miles are under construction. This railway is of the 3 ft. 1 in. gage as well as the shorter Usambara Railway, of which 155 miles have been opened to traffic.

BALTIMORE & OHIO IMPROVEMENTS.

The Baltimore & Ohio is planning to begin work early in April on extensive improvements at Garrett, Ind., including a general enlargement of the terminal facilities, the erection of a new roundhouse, turntable and pits, and the enlargement of the shops to handle classified repairs.

COMPARATIVE REGISTRATION FIGURES.

Last year the total registration of members of the Engineering Association during the three days of the convention was 351. On the first day, 287 registered; on the second day, 51; and on the last day, 13. This year 386 members registered; 296 on the first day, 76 on the second day and 14 on the last day.

TRIP TO BUFFINGTON AND GARY.

The party which is being made up to go to Buffington, Ind., and Gary will meet at the La Salle Street Station this morning and take the Lake Shore & Michigan Southern train leaving at 10:30. Special Pullman cars will be attached to this train. It arrives at Buffington at 11:15, giving about an hour for inspecting the works of the Universal Portland Cement Company, before luncheon, which will be served in the company's clubrooms. Immediately after luncheon the party will take special cars on the interurban to Gary, returning at the end of the afternoon and arriving at Chicago at 6:15.

Members of the A. R. E. A., their guests and members of the Appliances Association are invited to join the party. The trip is being arranged by L. J. MacMahon of the cement company.

REGISTRATION—AMERICAN RAILWAY ENGINEERING ASSOCIATION.

ACTIVE MEMBERS.

Brown, H. W., Asst. Eng., Pennsylvania Lines, Logansport, Ind.
Davis, Garrett, Supt., C., R. I. & P. Ry., El Dorado, Mo.
Delo, C. G., Eng. M. W., C., G. W. R. R., Chicago, Ill.
Duncan, K. B., Office Eng., A., T. & S. F. Ry., Topeka, Kan.
Frame, J. T., Eng. M. W., C. G. W. R. R., Clarion, Iowa.
Gray, Edward, E. M. W., Sou. Ry., St. Louis, Mo.
Henoch, M. J., Con. Eng., Sioux City, Iowa.
LaFountain, N. H., Asst. Supt. B. and B., C., M. & St. P. Ry., Chicago, Ill.
MacPherson, Duncan, Asst. to Chairman, Nat. Trans. Ry., Ottawa, Ont.
Petersen, W. H., Eng. M. W., C., R. I. & P. Ry., Davenport, Iowa.
Spencer, C. B., Office Eng., St. L. & San Francisco Ry., Springfield, Mo.
Williams, W. D., Chief Engineer, C. N. R. R., Van Wert, Ohio.
Wilson, C. A., Consulting Engineer, Cincinnati, Ohio.

ASSOCIATE MEMBERS.

Maher, John, Asst. Div. Eng., B. & O. R. R., Flora, Ill.

GUESTS.

DeWitt, Elmer, Penna. Steel Co., New York.
Currier, A. M., Office Eng., Cleveland Short Line Ry., Cleveland, Ohio.
McConnell, E., Roadmaster, A., T. & S. F. Ry., Marceline, Mo.
Baird, W. W., Roadmaster, A., T. & S. F. Ry., Marceline, Mo.
Grant, E. W., Asst. Eng. A., T. & S. F. Ry., Topeka, Kan.
Workman, Franz, Eng., B. M. Process, New York, N. Y.
Clough, A. M., Supr. Mach., N. Y. C. & H. R. R. R., Batavia, N. Y.
Cherrington, Frank, Cincinnati Wood Preserving Co., Cincinnati, Ohio.
Galloway, C. W., Gen. Supt., B. & O. S. W. R. R., Cincinnati, Ohio.
Kloss, H. E., Asst. Div. Eng., Grafton, W. Va.
Curry, G. M., Vandalia R. R., St. Louis, Mo.
Currier, A. M., Off. Eng., C., S. L. Ry., Cleveland, Ohio.

THE STORAGE BATTERY IN RAILWAY SERVICE.*

BY L. C. FRITCH,
Chief Engineer Chicago-Great Western.

THE LEAD CELL.

Until quite recently the only type of cell that has been extensively adopted in commercial service of all kinds is the lead cell. This cell consists of two lead plates or two groups of such plates which constitute, respectively, the positive and negative electrodes, immersed in a solution of dilute sulphuric acid. Each plate consists of a metallic support, or grid, which acts as a support for the active material, and at the same time serves to conduct the electric current to the point where connection is made to the external circuit. The active material of the positive plate, when fully charged, consists of lead peroxide represented by the symbol PbO_2. This lead peroxide in a healthy cell has a dark chocolate brown color. The active material of the negative plate in a fully charged cell is spongy metallic lead, and is slate gray in color. During discharge the peroxide is reduced to a lower state of oxidization and combines with a portion of the sulphuric acid in the electolyte forming lead sulphate ($PbSO_4$), which, being insoluble, remains on the plate. At the same time the spongy metallic lead of the negative plate becomes oxidized, and also combines with a portion of the sulphuric acid of the electrolyte, forming sulphate of lead on the negative plate. During discharge, therefore, it will be seen that the electrolyte loses some of its sulphuric acid, and becomes weaker. When the cell is recharged the lead sulphate on the two plates is decomposed, the sulphuric acid is restored to the electrolyte, while the active material on the positive plate again becomes lead peroxide, and on the negative plate spongy metallic lead.

The chemical action above described may be expressed in the form of the following equations:

$$PbO_2 + H_2SO_4 = PbSO_4 + H_2O + O \quad (1)$$

$$Pb + H_2SO_4 = PbSO + H_2 \quad (2)$$

$$(1) + (2) = PbO_2 + Pb + 2H_2SO_4 = 2PbSO_4 + 2H_2O \quad (3)$$

Equation (1) represents the reactions which take place at the positive plate, and equation (2) at the negative plate during charge, and equation (3) the combined effect or fundamental equation of the storage battery and is the reaction which takes place on discharge.

THEORY OF CHEMICAL REACTION OF EDISON CELL.

Starting with oxide of iron in the negative electrode, green nickel hydrate in the positive electrode and potassium hydrate in the electrolyte, the first charging of a cell reduces the iron oxide to metallic iron while converting the nickel hydrate to a very high nickel oxide, black in color.

On discharge, the metallic iron is converted back to iron oxide and the high nickel oxide to a lower oxide, but not to its original form of green hydrate.

In every cycle thereafter the negative active material charges to metallic iron and discharges to iron oxide, while the positive active material charges to a high nickel oxide and discharges to a lower oxide.

Current passing in the direction of charge or discharge decomposes the potassium hydrate of the electrolyte, and the oxidation and reductions at the electrodes are brought about by the action of its elements. An amount of potassium hydrate equal to that decomposed is always reformed at one of the electrodes by a secondary chemical reaction, and as a result none of it is lost and its density remains constant.

The result of charging, therefore, is the transference of oxygen from the negative to the positive electrode and a discharging of a transference back again of oxygen from the positive to the negative electrode.

A description of the component parts of the Edison Batteries follows:

*From a paper published in Bulletin 145 of the American Railway Engineering Association, March, 1912.

The positive plate consists of one or more perforated steel tubes, nickel plated, filled with alternate layers of nickel hydroxide, and pure metallic in thin flakes which form the active material.

The tube is drawn from a perforated steel ribbon, and has a spiral lapped seam. After being filled with the active material, the tube is reinforced with eight steel bands equally spaced to prevent expansion and breaking of contact of tube with its contents.

The negative plate consists of a grid of cold-rolled steel, nickel plated, holding a number of rectangular pockets of perforated steel, also nickel plated, which contains powdered iron oxide, the active material. After the pockets are filled they are inserted in the grid and compressed between dies, corrugating the surface of the pockets, and forcing them into integral contact with the grid.

The electrolyte consists of a 21 per cent solution of potash in distilled water, added to which is a small per cent lithia.

SIGNALING.

In signal service the storage battery has, in many situations, supplanted the primary battery. It is generally found less expensive to maintain, and it also offers other advantages over the primary cell, such as low internal resistance, uniform voltage and large output for intermittent service, such as the operation of motor-driven signals. In some cases portable batteries are employed for this purpose, which are collected at regular intervals for charging at some convenient charging point, a certain number of spare batteries being provided for service while the discharged cells are being charged. In other systems the batteries are charged without removal by a charging circuit which extends along the right-of-way, into which the cells may be connected in series. Duplicate batteries are installed, one of which is connected to the charging circuit, while the other is supplying the current to the signals. In some cases the storage cells are connected in parallel with a sufficient number of primary cells of the "gravity" type. These primary cells supply a small amount of current continuously, sufficient to keep the storage cells fully charged, while the storage cells, on account of their low internal resistance, furnish the high momentary current demands for operating the signals.

DRAWBRIDGE OPERATION.

The introduction of storage batteries for supplying current for operating motor-driven drawbridges has been quite general of recent years. The battery in this service has two important functions. The first is to provide an absolutely reliable source of current which is not subject to interruption. Accidents which have occurred, due to failure of power while a large vessel, under considerable headway, is approaching a partially opened drawbridge, have shown the necessity for such an auxiliary supply of current. The second function is to provide, by means of a small continuous current supply, for the heavy intermittent service required. The 24-hour average demand of the drawbridge is usually very small as compared with the momentary maximum demand. By the installation of a storage battery, the primary source of current, which may be a dynamo driven by a gasoline engine, or a motor generator set operated by alternating current supplied from a distance, may be only sufficient for the average requirements, and for charging the battery at its normal rate. On discharge, the battery may be called upon for an output up to eight times its normal rate, or under certain conditions for even greater discharge rates.

J. G. Shillinger, engineer of maintenance of way of the Cleveland-Indianapolis division of the Cleveland, Cincinnati, Chicago & St. Louis at Galion, O., has been appointed chief engineer of the Rutland Railroad, with office at Rutland, Vt., succeeding J. C. Irwin, resigned, effective April 1.

At the Coliseum

ATTENDANCE AT THE EXHIBIT.

The Engineering Association finished its third day's work in one session yesterday, and adjourned about noon,—the earliest hour in several years. An unusually large number of the members took advantage of this chance to visit the exhibits during the afternoon.

A noticeable characteristic of the interest of railway men in the exhibits this year is that it is much more definite than in previous years. Men come this year to see some one thing in particular first, and then take in the other exhibits. The exhibition is really more than annual. It is perennial. This fact has led visitors to make plans in advance as to what they may want to see, and to look for these things. The custom a good many supply men have of getting the same location each year helps to make exhibits easy to find; and the many lines of railway work represented by the visitors makes it practically certain that each one of the spaces is visited first by somebody.

The general opinion among exhibitors seems to be that the exhibition is the best yet, and that they have profited greatly by the publicity connected with it. The attendance, including as it does such a large number of representative railway officers in engineering and executive positions, has made up in quality, perhaps, what it lacks in quantity, though it was better yesterday than the day before when the blizzard kept so many away. The interest was well divided between the Armory and the Coliseum. The many signs and guides to the Armory helped greatly to direct the crowds toward it.

Last night was "popular night" at the Coliseum. There were more people in attendance who are not directly connected with railway work than at any previous time. That they were interested was shown, however, by the pleasure they found in looking over the exhibits.

FIRE-RESISTING PAINT.

The increased number of fires on bridges and trestles, resulting from the operation of the self-dumping ash-pan law, has convinced most roads that some form of protection is necessary. Tests of the paint made by the Clapp Fire-Resisting Paint Company, Bridgeport, Conn., have been noted heretofore in the Railway Age Gazette. While this paint has been in use on certain eastern roads for several years, it is only during the last year that it has been tried experimentally by some western roads, including the Illinois Central, the Chicago, Burlington & Quincy and the Chicago Great Western. The Canadian Pacific, which had been experimenting for some time, is now applying this paint to many of its bridges. An instance of its use on buildings is a switchman's shanty in one of the freight yards in Chicago. Before being painted with this paint, the roof of this shanty caught fire from locomotive cinders about every six weeks, but there has been no fire since the application of the Clapp paint several months ago.

THE USE OF SHEET METAL FOR RAILWAY PURPOSES.

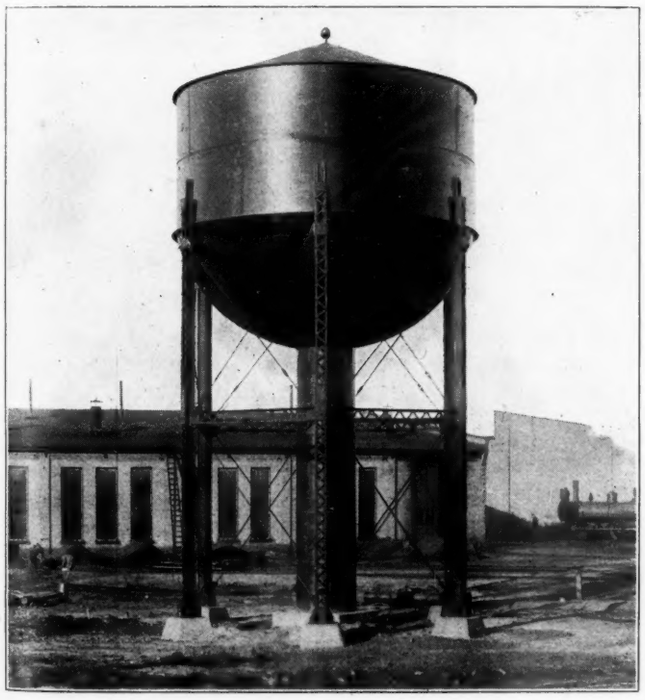
One of the factors, if not the main factor, that have prevented the extensive use of steel and iron sheets for railway work, is the tendency developed by users other than railways, and catered to by the mills themselves, to cut down first cost by the use of gages lighter than the requirements really demanded. This tendency has in the past few years been so general and so excessive that the sheet metal industry has lost a great deal of ground and substitutes have been sought. Some of the manufacturers of open hearth steel sheets came to the conclusion that all metal

products should be rolled full weight to United States standard gages. Among these is the Stark Rolling Mill Company of Canton, O., makers of Toncan metal sheets, who do not vary from this rule. This has had much to do with the success of their corrugated culverts made of Toncan metal, now used by many leading railway systems. The gage is full standard; the heavier gages are recommended; the galvanized coating is pure and heavy, standing the four-dip copper sulphate test in all cases. These basic conditions, coupled with care in making up the culverts, whether nestable or round riveted, make them satisfactory for use in compliance with rigid requirements. The material is used not only for culverts, but for roofing, siding, eaves troughs, conductor pipes, ventilators, skylights, etc.

STEEL WATER TANKS.

The accompanying photograph shows a steel tank and tower of 100,000 gals. capacity above the 30-ft. line, built by the Des Moines Bridge & Iron Company, Pittsburgh, Pa., for the Northern Pacific at Zero, Mont., where extremely low temperatures continue for many consecutive days.

Among other features of this design are the proportions of the tank, the diameter being relatively large, usually exceeding the depth about 30 per cent. The segmental bottom has a very short radius of curvature, and, consequently, low bursting stress. The tank bottom has a decided slope, very pronounced even at the riser-pipe opening,



Tank at Zero, Mont.; Northern Pacific.

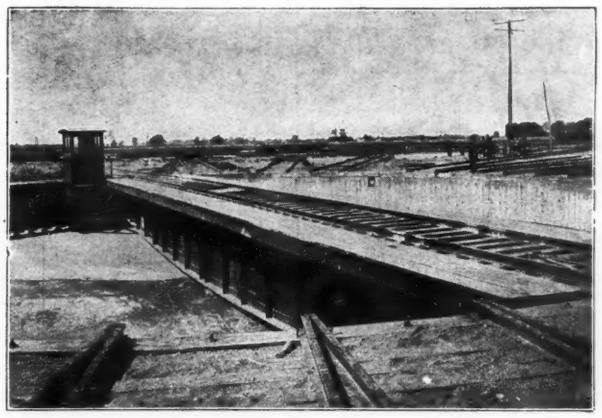
and the tank, therefore, is self-cleaning for ordinary conditions. For water carrying large quantities of silt, the lower portion of the bottom is built in the shape of a cone having a slope of one to one, making the tank surely self-cleaning. A simple and effective blow-off valve is provided so that all sediment may be removed while the tank continues in service.

For structures of this type the riser-pipe is usually a riveted steel cylinder of large diameter, making wood frost casing unnecessary. It also serves as a sedimentation basin, and, when used, the blow-off valve is located in its bottom. The riser-pipe has an expansion-joint connection to the tank bottom so that no undesirable stresses will be induced in the structure as a result of unequal expansion or contraction due to temperature changes or uneven settlement of the foundations. Another feature is that all surfaces are accessible for inspection and painting. With ordinary care these tanks should last indefinitely.

FAIRBANKS-MORSE ELECTRIC TURNTABLE TRACTOR.

Fairbanks, Morse & Co. have on exhibition at the Coliseum an electric turntable tractor.

This tractor is claimed by the manufacturers to be as simple and "fool proof" a piece of mechanism as it is possible to install for this purpose, with no more parts than



Fairbanks-Morse Electric Turntable Tractor Installation; Michigan Central, Windsor, Ont.

is necessary, yet everything accessible for easy adjustment or replacement, and built for the particularly heavy duty to which it must of necessity be subjected. The outfit is of the three point bearing type, being fastened to the turntable at two points by heavy forged strap hinges, the third point being the tractor wheel resting on the pit rail.

The tractor frame is of the "A" type, of heavy construction and well gussetted. A compartment for ballast to increase the adhesion of the outfit to the rail forms a part of the tractor frame. The tractor is made so that the floor of the cab is on a level with the base of the engine rail. This feature is departed from only when the pit is extremely shallow and insufficient head room will not be left below the floor for the reception of the mechanism.

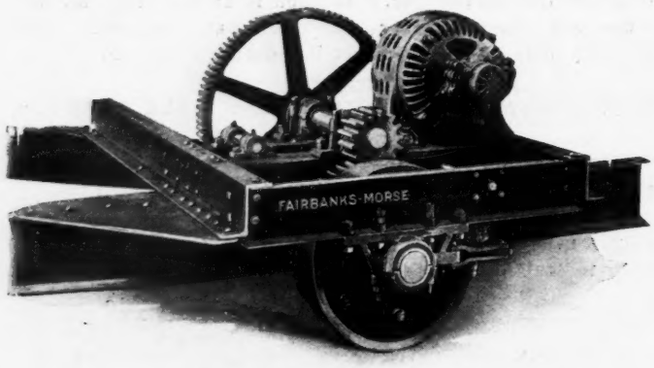
A noticeable feature is the fact that the main driving gear transmits the power to the tractor wheel by being bolted direct to the tractor wheel by six turned studs in reamed holes, and not by being keyed to the tractor wheel shaft and driving through these keys. The tractor wheel has a chilled tread and the braking effect is obtained by means of two brake shoes placed on opposite sides of this tractor wheel, bearing on the tread and putting the braking effect where it is most needed and not braking through gears and keys.

A sanding device is arranged so as to apply sand to the pit rail on either side of the tractor wheel, dependent, of course, on the direction of the turntable.

A cabin, which is shipped in five pieces ready for immediate erection, is furnished with each outfit. This is fitted with four windows, three of which are sliding, and a swing door.

The cabin is bolted together with long tie rods and held to the operating floor by means of vertical tie rods extending from the roof timbers through the steel floor support.

The mechanism under the operating floor is enclosed with galvanized steel panels with covered hand holes for easy access to oil bearings. These panels are fitted with

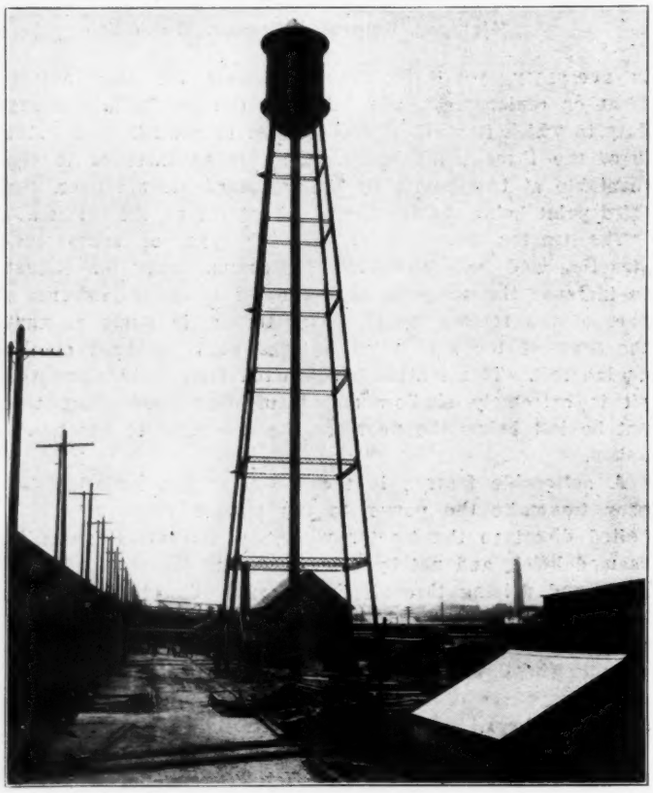


Fairbanks-Morse Electric Turntable Tractor.

an improved method for easy removal so that the mechanism can be exposed on all four sides without the use of tools.

BOSTON & MAINE WATER TOWER.

One of the tallest water towers ever built is that recently constructed for the Boston & Maine on the Cunard docks at Boston, Mass. This tank, which has a capacity of 100,000 gals., is 239 ft. high to the maximum water line and 200 ft. high to the lowest point of the tank bottom. The object of



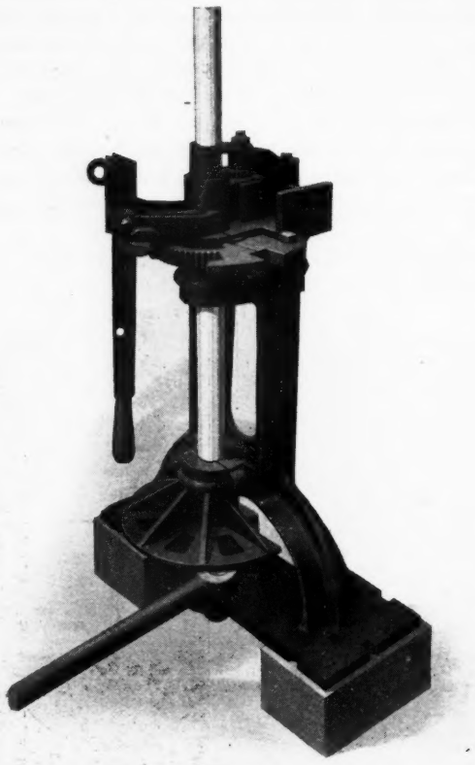
Boston & Maine Water Tower.

building a structure of such height was to protect the large nearby elevators from fire. The tower was designed for a wind pressure of 30 lbs. per sq. ft. over one-half of the diametral plate of the tank, with a load of 200 lbs. per vertical ft. of tower. The structure was designed and built by the Chicago Bridge & Iron Works, Chicago, in accordance with their standard practice.

A NEW ADJUSTABLE SWITCH STAND.

A large number of devices of various kinds have been used in the last ten years for adjusting the points of split switches. These devices have been of many forms, although most of them applied to the head rod of the switch. The screw, the eccentric, the wedge, the sawtooth, staggered holes, etc., have all had their turn, and they have all been open to more or less criticism. Recently there has developed a tendency to make switches with the rods rigid and with a fixed throw and do the necessary adjusting in the switch stand itself. Several stands possessing this adjustable feature have been designed.

The accompanying cut shows a stand of this type in which the table is made in two segments so arranged that they may be moved and fixed in any position to vary the throw of the switch. The principle, and in fact the device itself, is simple, and can be used with any stand, either high or low, of the ordinary revolving or circular throw type. In the ordinary stand of this type, the throw is fixed by the length of the



Adjustable Switch Stand.

crank, and the handle operating the mast and crank is in nearly all cases moved through an arc of 90 deg.

In the new adjustable stand, the throw is varied by changing the position of the adjustable segments, as each segment carries a locking notch for the handle. By varying the position of the notches, the throw of the crank is varied from 90 deg., or its greatest throw, to about 60 deg., its minimum. In actual practice, a variation in throw of two inches is obtained. Not only is the throw of the stand variable, but by moving either one or both of the two notched segments either switch point can be adjusted independently of the other.

The targets and lamp top are carried on a mast in the center of the stand, but independently of the crank, and are operated automatically with the movement of the handle by an enclosed spring between two fixed abutments, so that no matter what arc the handle and crank move through, the targets and lamp always revolve exactly the required 90 deg.

Another interesting feature in connection with this stand

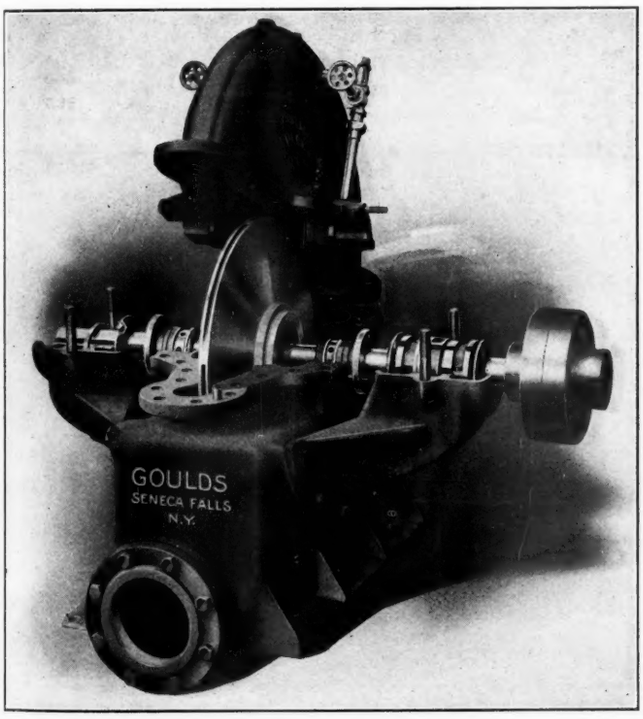
is the arrangement of the crank and the connecting rod. The crank is of the ordinary upturned type, and a special semi-circular wing-shaped casting which forms part of the lower journal of the mast fits closely over the top of the crank, preventing the connecting rod from encountering any chance misplacement, as at no period of the throw can the rod become disengaged. To install and connect up to the switch, the "U" bolt holding the protecting casting is removed and then replaced after the connecting rod has been slipped on to the upturned crank.

This stand has just been placed on the market by the Morden Frog and Crossing Works, Chicago, and is being shown and demonstrated at their booth in the First Regiment Armory.

CENTRIFUGAL PUMPS.

The Goulds Manufacturing Company, Senaca Falls, N. Y., has recently placed on the market an entirely new line of centrifugal pumps. These pumps are furnished in both the single-stage, single-suction and the single-stage, double-suction types. Either type may be arranged for belt drive or direct connection to electric motor, gas, gasolene or steam engines, steam or hydraulic turbines. These pumps are especially suitable for railway tank pumping, and general water supply where the elevations do not exceed 150 ft. They are also used in circulating hot water in heating systems, pumping water for condenser service and other similar services in the power plant or shops.

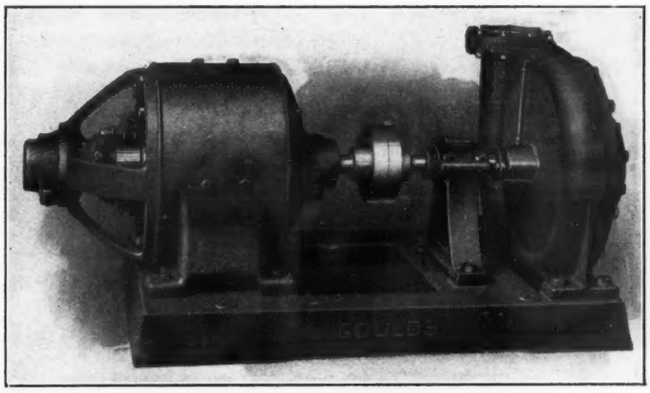
The impeller in the single-suction pump is of the open type and the clearances between the impeller and the side



Goulds Double Suction Pump.

covers are reduced as much as possible. This latter feature has considerable influence upon the efficiency which is obtained with this type of pump. Although of the single-suction type, which in most cases means considerable end thrust, the impeller is so designed as to minimize this annoying feature. The stuffing box, through which the shaft passes, has a brass water sealing ring which prevents air being drawn into the pump at this point. Air will destroy the vacuum in a pump and impair suction.

The casting proper of the single-stage, double-suction centrifugal pumps consists of two castings bolted together on a horizontal joint. The purpose of dividing the castings is to permit quick and ready access to the interior parts of the pump for inspection, without disturbing the pipe connec-



Goulds Single Suction Pump.

tions. The impeller is of the enclosed type, developing high efficiency under conditions for which the pump is sold. The bearings are of the ring-oiling type, independent of the stuffing boxes and are provided with removable shells lined with anti-friction metal.

CHEMICAL WEED DESTROYER AND TRACK PRESERVATIVE.

Weeding ballast in Porto Rico involves considerable expenditure. The season of heavy sugar traffic extends from December until August and during that time three months of the dry season and three months of the rainy season are experienced. The ballast generally used consists mainly of coral rock and sand. Vegetation is always present during all seasons, but is especially heavy in the rainy weather. To eliminate this vegetation, from five to eight constant hand-weeding operations are required annually. Labor for this class of work can be obtained for 50 cents a day and the estimated expenditure per mile per year is $70.

The Atlas A chemical weed destroyer and track preservative, made by the Atlas Preservative Company of America, New York, was used for a season on one of the Porto Rican railways. A representative of the Atlas company was sent out to study the conditions and see if the economies of the chemical treatment warranted further activity in that field. It was found that three chemical treatments in the first year and one treatment each succeeding year would be sufficient to eradicate the entire growth. This would mean an expenditure in the first year of about 10 per cent more than the previous annual cost and a saving in each future year of from 50 to 60 per cent. These figures are based on labor at 50 cents a day, as against over $1.00 a day in the United States.

In the United States, wherever the growing season does not exceed seven months, one treatment a year with progressively weaker strengths is sufficient. Comparing the conditions of vegetation in the tropics with those in the United States, the benefit in economies effected is much in favor of the United States if the chemical treatment is made, and much in favor of the tropics if hand weeding is resorted to. This statement is strengthened by the fact that vegetation is much more vigorous and reappears more quickly in a climate where the growing is confined to the summer months. In the spring growing in the United States, hand weeding could be accomplished each three weeks, but in the tropics, each six weeks would be sufficient to keep a track clear.

INTERIOR HARBORS AS MEANS OF PROVIDING ECONOMICAL TERMINALS AND PREVENTING CONGESTION.

There has been a marked tendency during the last ten years toward the development and extension of interior harbors, not only in the United States but throughout the world. Experience, it is contended by their advocates, has shown that interior harbors prevent congestion and supply economical sites for industries and railway terminals, and that it is becoming apparent that the greatest commercial, industrial and manufacturing cities have internal harbors and that cities

Scherzer Rolling Lift Bridge for C., L. S. & E. at Indiana Harbor, Ind.

with outer harbors only become congested and remain comparatively small.

On the Great Lakes important inner harbor improvements have been made at Buffalo, where the Buffalo river has been widened, deepened, straightened and extended farther inland. At Cleveland the Cuyahoga river has been straightened and most of the obstructive center pier swing bridges have been removed and replaced by modern bascule bridges. At Chicago progress has been made in this same direction by the building of the Sanitary ship canal, forming an extension of the inner harbor of Chicago. At Milwaukee and Duluth similar deepening, straightening and improving of the rivers has been going on.

In all of these cities the improvement of the inner harbors has resulted in a great increase in industrial development and population and consequent increase of railway traffic. The building of the East Chicago canal has been the most recent progressive enterprise in the development of the inner harbor system. The success of the East Chicago canal in creating and developing a great industrial center within a few years demonstrates the soundness of the inner harbor in principle and its great usefulness for economical, industrial and transportation development.

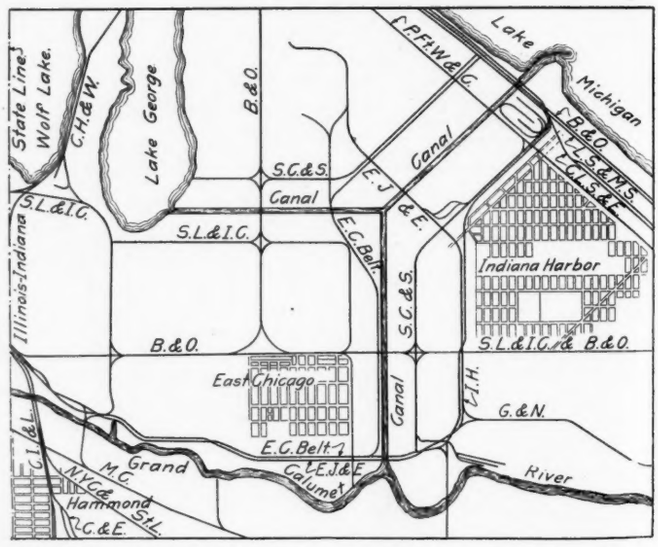
A glance at the accompanying map of the East Chicago canal shows that, in form, it is an artificial duplicate of the main Chicago river, with its north and south branches, thereby providing the railways and industries in the vicinity of East Chicago with the advantages of lake terminal facilities without the expense and congestion connected with outer harbors. The canal has opened up large areas of land for industrial development which without it would have remained of comparatively slight value.

The building of this interior harbor is regarded by those favoring interior harbors as an especially progressive step in view of the fact that nearly all the leading railways entering Chicago from the East cross this canal, and by private negotiations agreed to the construction of movable bridges. The slight inconvenience of a modern movable bridge became insignificant when considered in relation to the great industrial and traffic expansion resulting from the construction of the canal.

The East Chicago canal will connect up with the Grand Calumet river and also the sag Calumet channel of the Sanitary District of Chicago, thus affording a further extension of the interior harbor system and opening up new territory to industrial and transportation development, all of which will be needed because this territory is rapidly becoming the most economical steel making and distributing center in the world, making capital investments within this territory very safe and productive.

This vast interior harbor and traffic development is secured at a comparatively small cost in so far as bridges to cross the navigable channels are concerned. In fact one hundred modern movable bridges can be constructed and maintained for the capital cost involved in the building of a single Brooklyn bridge at New York, because the Brooklyn bridges are elevated 150 ft. above the surface of the water, whereas the draw bridges at Chicago are constructed virtually at grade. In other words, by means of modern movable bridges the industrial and commercial districts around Chicago obtain all the economic advantages of a great interior harbor system at a comparatively small capital investment.

The Scherzer rolling lift bridge has been of valuable assistance in this industrial and transportation development. One double-track Scherzer rolling lift bridge has been already constructed for the Lake Shore & Michigan Southern,



Relation of East Chicago Canal to Railway and Industrial Development.

and another double-track bridge for the Chicago, Lake Shore & Eastern near the entrance to the East Chicago canal. Another Scherzer rolling lift bridge is under construction for the Elgin, Joliet & Eastern. One has recently been completed and carries the electric railway and highway traffic across the channel at Hammond, and two additional bridges of the Scherzer type are now being constructed to carry highways and the Chicago, Lake Shore & South Bend lines across the canal at East Chicago. The photograph herewith showing the Chicago, Lake Shore & Eastern's bridge is, in general, typical of these modern movable bridges.